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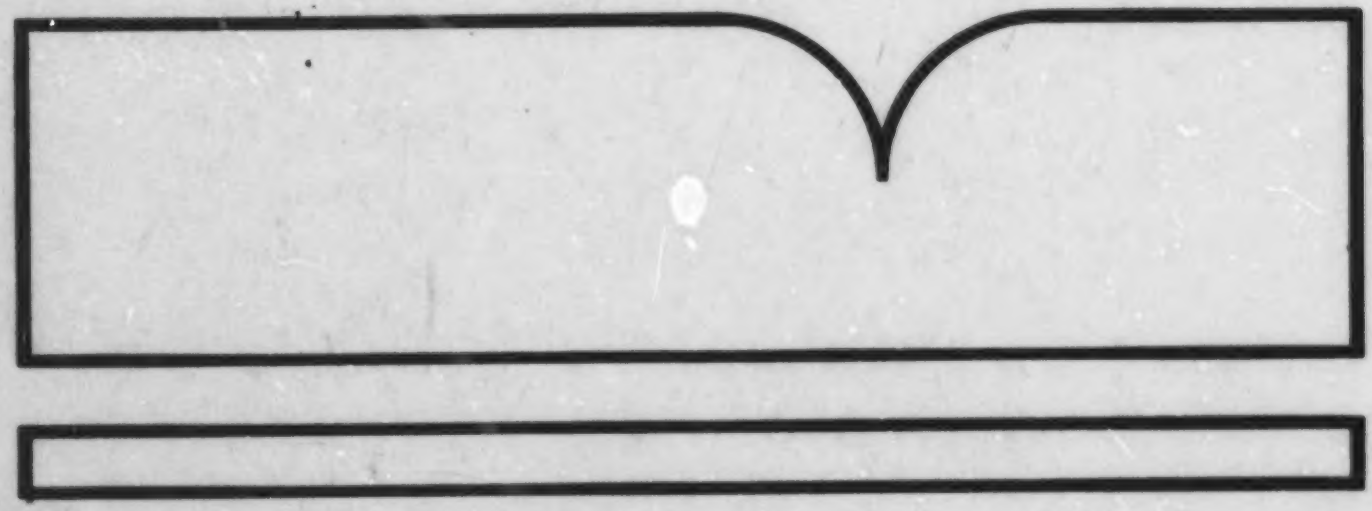
Carbon Monoxide Commuter Exposure Data Base
A 5-Day Study in Los Angeles

(U.S.) Environmental Sciences Research Lab.
Research Triangle Park, NC

Aug 81



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A 5-Day Study in Los Angeles

by

William B. Petersen,[1] Rodney H. Allen[2], Richard A. Ziskind[3], and Michael B. Rogozen[3]

(1) Meteorology and Assessment Division
Environmental Sciences Research Laboratory
Research Triangle Park, NC 27711

(2) Comp-Aid, Inc.
Research Triangle Park, NC 27711

(3) Science Applications, Inc.
Energy-Environment Systems Division
Los Angeles, California 90067

ENVIRONMENTAL SCIENCES RESEARCH LABORATORY
OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

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AUTHOR'S AFFILIATION

William B. Petersen, is on assignment with the U.S. Environmental Protection Agency from the National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

ABSTRACT

Recent concern about carbon monoxide exposure to the commuter population prompted the U.S. Environmental Protection Agency to conduct a five-day field project to assess the CO exposure to Los Angeles commuters. the purpose of this report is to document the field project and to provide the data collected during the project to the public. The data collected during this project includes measurements of interior carbon monoxide, exterior carbon monoxide and vehicle speed for three vehicles traveling typical commute routes during the morning and evening peak traffic periods. In addition, hourly average CO measurements were taken from eight-South Coastal Air Quality Management District fixed-site monitoring stations and six California Transportation Agency vans in the proximity of the commuter routes.

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SECTION 1
INTRODUCTION

During October 1 through 5 1979, Science Applications Incorporated, under contract with the U.S. Environmental Protection Agency, conducted a field study to monitor carbon monoxide concentrations both inside and outside three vehicles traveling typical commute routes in Los Angeles county. The vehicles traveled typical commute routes during the morning and the evening peak traffic periods. Two Interscan continuous CO analyzers were installed in each vehicle to monitor CO levels simultaneously inside and outside the vehicles. The outside sampling probe was located near the fresh air intake, while the inside probe was located near the driver's breathing zone. The instrumentation, route selection, monitoring conditions, and observed data are presented in this document.

The data collected for this project included recorder time traces of interior carbon monoxide (CO_{INT}), exterior carbon monoxide (CO_{EXT}) and vehicle speed. Accompanying these were the technician log sheets describing conditions present as data were taken. Conditions included location, roadway description, degree of traffic congestion, and vehicle comfort state. In addition, hourly average CO measurements were taken from eight South Coastal Air Quality Management District fixed-site monitoring stations and six California Transportation Agency vans in the proximity of the commuter routes chosen.

The analog traces of carbon monoxide concentration and vehicle speed were digitized at one-minute intervals, which correspond to 0.5 cm widths of the recorder trace. The data were digitized by one of two methods. If the quantity could be digitized by eye, this was done. If the curve was too complex, a

trapezoidal integration and averaging algorithm was used with the aid of a programmable calculator. Digitizing techniques are discussed in Appendix C.

Technicians' logs were examined and each commute run was subdivided into discrete intervals. During each time interval all significant observable conditions were considered to remain constant and thus adequately describe the state under which the data were taken. The minimum interval was chosen to be one minute. No interval exceeded 15 minutes.

This document describes the instrumentation used in the study, the route selection and experimental design, and the development of the data base. Appendices A and B present the exposure and fixed site data. Appendix C describes the methodology use to estimate the one-minute averages and Appendix D presents a graphical display of the exposure data.

SECTION 2
INSTRUMENTATION

Carbon monoxide was measured using two Interscan 1146 portable, continuous analyzers in each vehicle. The Interscan device is a direct reading, battery operated unit with integral sample pumps and battery charger. The detection element is an electrochemical voltametric sensor. The unit is designed for over eight hours of continuous field operation between recharges. The detection ranges are 0 to 50 and 0 to 100 ppm. The electrical output is connected to a Soltec VP-6723S 2-pen portable strip chart recorder. This device has a built-in battery charger and a "glitch" marker push-button feature, which is useful for correlating recorder trace location with technicians' log comments.

Instrumentation for vehicle speed measurements consisted of a magnetic transducer pickup, pulse analyzer and converter circuitry, and a Soltec recorder. The pickup was attached to the front right disc-brake caliper. Its output was a pulse train with rate proportional to the number of

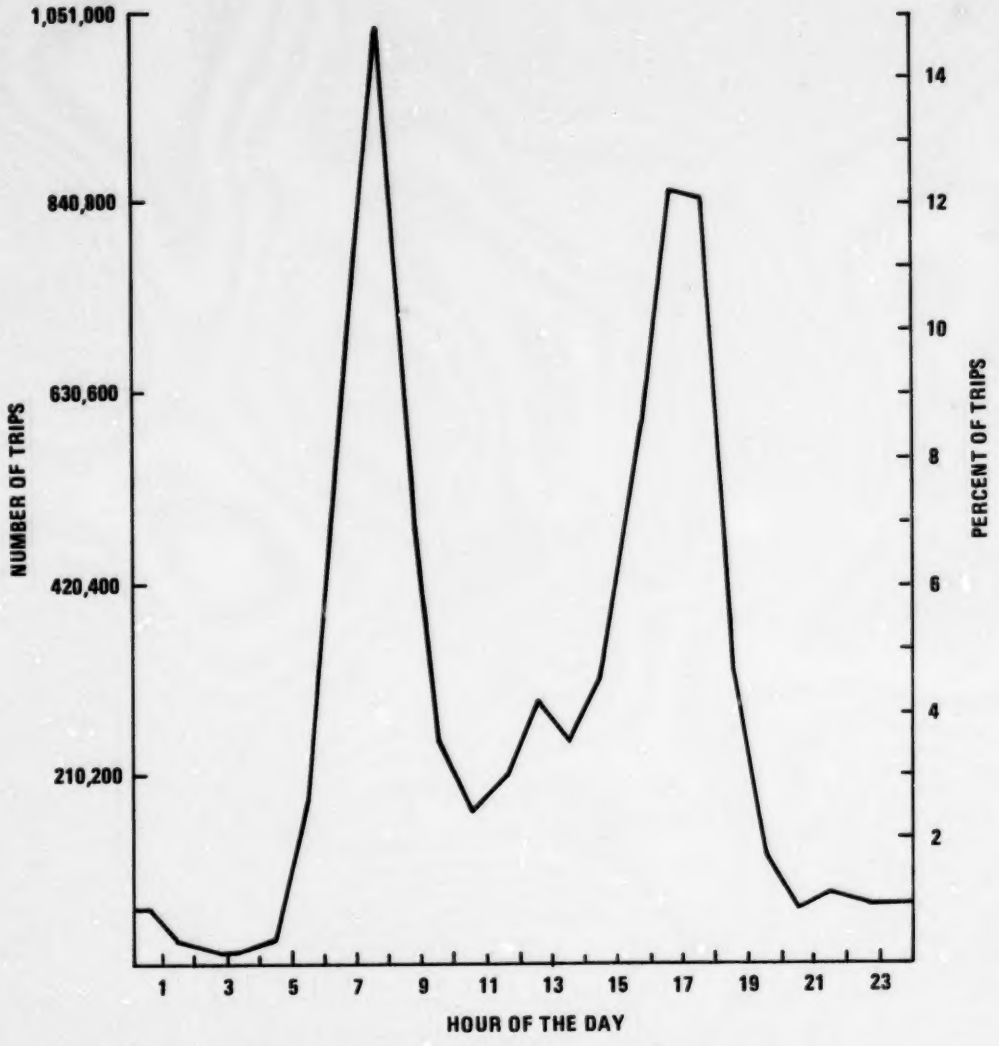

Figure 1. Work driver trips in motion by hour of the day.

ventilator rotor disc slots passing in a unit time. This pulse output was converted to a linear analog direct current voltage which provided the Soltec recorder input.

The recorders were run either by the 12 volt vehicle battery or by means of their internal batteries. The vehicle speed detector was initially calibrated by direct computation and subsequently checked for consistency against the vehicle speedometer. The CO analyzer/recorder combination was calibrated daily using span gases. The calibration procedure consisted of initially zeroing both CO analyzers and a recorder after a warm-up period and then filling the air bag with calibrated gas in order to span the devices and adjust the recorder markings. It was found that the daily spanning adjustment requirement was slight. All batteries were recharged overnight. The instrument package was situated on the rear seat with air inlets located at the driver's breathing zone and on the vehicle hood at the fresh air inlet positions.

SECTION 3
ROUTE SELECTION AND EXPERIMENTAL DESIGN

The monitoring periods and routes were chosen to correspond to representative commuter trips throughout the Los Angeles area. Figure 1, taken from the California Transportation Division's, (CALTRANS) Los Angeles Regional Transportation Study of 1976, confirms the choice of monitoring periods between 6:30 and 9:30 am and 3:30 and 6:30 pm. Although no specific available "typical" commuter routes have been published, general knowledge of the traffic patterns, along with other factors such as traffic counts, was used to select vehicle routes. Each vehicle essentially simulated two commuter travel patterns. It was desired to partition the mileage driven so that freeway and arterial driving accounted for roughly 80 and 20 percent, respectively. Furthermore, the routes all covered some portion of the "42-mile loop." This loop is instrumented by CALTRANS to provide real-time traffic volume and speed data. A final consideration was the proximity of routes to air quality monitoring stations. Since the latter are placed throughout the area, there was no problem in locating routes near fixed site stations.

The three Plymouth Valiants used in this study traveled morning and afternoon commute routes. The morning routes are labeled Routes 1,2, and 3, respectively. The afternoon routes are labled 4,5, and 6. Car 1 traveled routes 1 and 4; car 2 traveled routes 4 and 5; and car 3 traveled routes 3 and 6. The three vehicles followed the prescribed commute routes as nearly as possible during the five-day study, and traveled over the route as many times as possible during each three-hour period.

Each half hour during a commute run, a new comfort state was established in the vehicle, according to the schedule illustrated in Table 1. In order to provide an adequate description of the measurement conditions a detailed recording of real time information was made. An unambiguous correspondence among CO levels, vehicle speed and recorder observations was made by assigning an alphabetical code to each notation and simultaneously marking the log and chart papers by check marks in the progressive code letter. The following items were recorded in a trip log:

Data Recorded Initially

- Date
- Time of Start
- Vehicle Identification
- Route Identifier

Data Periodically Logged Throughout The Trip

- Time
- Alphabetical Code to Note Events
- Vehicle Comfort State Code
- Location and Direction
- Lane Number Position of Vehicle
- Total Number of Lanes
- Traffic Flow Observation (light, medium, heavy)
- Instrument Scale Setting
- Special Observations, Including:

  -Roadway description i.e., elevated tunnel, freeway, arterial underpass, at grade
  -Stopped condition
  -Proximity to vehicle with noticeable exhaust, or a bus, tractor trailers, or other distinctive vehicles
  -Crossed major intersections

The length of time stopped can be determined from the speed time trace.

Supplemental data were collected during and after the experiment. Peak hourly traffic volumes and daily totals for the numerous locations and intersections along each route were obtained from city, county, and CALTRANS records for the last year. The 42-Mile Loop is instrumented to provide real time information on hourly traffic volumes and average vehicle speed. Air quality stations located throughout the county all provide hourly CO averages, while some report relative humidity, temperature, wind direction and speed.

TABLE 1. VEHICLE COMFORT STATE (VARIABLE 7, COLUMN 16 IN APPENDIX A)

Vehicle Comfort	Windows		Air Conditioner		Heater		Vents	
State	Up	Down	On	Off	On	Off	Open	Closed
I	X		X			X		X
II	X			X	X			X
III		X		X		X	X	
IV		X		X		X		X
V	X			X		X		X

Definitions

Heater On: Temperatures on full (warm); fan on full, no bi-level

Air Conditioner On: Temperature on cold; fan on full

Vents Open: Fan speed on low

SECTION 4
DEVELOPMENT OF DATA BASE

The data collected in this experiment have been divided into two sets. The first, which is displayed in Appendix A, consists of exposure measurement, comfort state, vehicle speed, traffic and other supplemental data. The second, which is shown in Appendix B, consists of fixed monitoring station data. To facilitate computer analysis, the data in the first set have been organized into 132-character blocks, the format for which is shown in Table 2. Each block corresponds to one of the time intervals defined above, and represents from 1 to 15 minutes of measurement. Appendix A contains 714 of these blocks. Definitions of the codes for traffic index and street index are shown in Tables 3 and 4, respectively. The format for the fixed monitoring data blocks is presented in Table 5.

The only data added to the data base provided by SAI was a background CO concentration in ppm for each data block. The background CO concentration was estimated using a $1/R^2$ technique at the mid point of each block of data. We identified this rule as "Mid-block $1/R^2$." The mid point was the average latitude and longitude for the start of the current block and the start of the next block. If there is a missing time block after the current block, the latitude and longitude of the current block is used. If the background determined by the Mid-block $1/R^2$ rule was greater than the lowest measured concentration in the block, the background was set at that lowest value. For convenience in storing the data in 132 character records we had one column available for background concentration. The range of background values is 0 to 12 ppm; therefore we used hexidecimal representation (0-9, A, B, C).

TABLE 2. EXPOSURE DATA FORMAT (2I1,I4,I1,2I4,I1,I2,5I1,2I4, 2I2,I1,I2,I1,I2,A1,45I2)

VARIABLES	COLUMNS	CONTENT	DESCRIPTION
1	1	Day Range 1-5, units number	Monday, October 1 through Friday, October 5, 1979 were the test days.
2	2	Route # Range 1-6 units numbers	Routes 1-3 were the three independent morning routes. Routes 4-6 were the afternoon routes. Route pairs 1-4, 2-5,3-6 were designed to correspond to the same commuter(s) going to and from work.
3	3-6	Time of Day Range 337-1001 units HH MM hours minutes	Time needed to be expressed to the one minute level of detail, i.e., 0355, 1001. Note that times were recorded during A.M.-P.M. Times for routes 1-3 were in the range 6:30 - 10:00 am. Afternoon runs 4-6 covered 3:30 - 7:00 pm standard time.
4	7	Index denoting zero or stopped condition class Range 0 or 9, units class	In order to account for any break in data taking the digit 9 was inserted in column 7. Breaks occurred due to vehicle refueling and equipment zeroing.
5	8-11	Latitude Range 3510-4137 Units DMM.M Degrees minutes	The coordinates of latitude expressed in Column 8 are the last digit of the Los Angeles area in degrees; (Column 9-10) minutes; (Column 11) tenths of minutes. Note that the first digit of degrees that is being omitted is a 3.
6	12-15	Longitude Range 7548-8348 Units, DMM.M	The coordinates of longitude are expressed similarly to latitude. The last digit of degree is in column 12 (The first two digits of degrees for Los Angeles are 11 and are omitted); 13-14 are the minutes of longitude and 15 the tenths of minutes. Latitude and longitude were averaged over the time period during the interval in order to center the vehicle's locations.
7	16	Vehicle Comfort State Range 1-5, units class	Table 1 defines each state with respect to windows, air conditioning, heater and vents. These are set by the technician with each state retained for about 30 minutes.

TABLE 2 (continued)

VARIABLES	COLUMNS	CONTENT	DESCRIPTION
8	17-18	Lane and Total Number of Lanes Range 0-59, units number	Lane number is counted from the center (or fast) lane and total number of lanes includes those in both directions. A zero indicates unknown. A nine for total lanes means nine or more.
9	19	Traffic Flow Observation Range 0-3, units class	0 = unknown, 1 = light, 2 = medium, 3 = heavy.
10	20	Congestion Index Range 0-2, units class	0 = unknown, 1 = stop and go, 2 = free flow.
11	21	Stop at Intersection Range 0-1, units class	0 = no, 1 = yes. This index only indicates stops which occur for a significant period rather than few seconds.
12	22	Roadway Type Range 0-5, units class	0 = unknown, 1 = open surface street, 2 = urban canyon, 3 = depressed freeway, 4 = elevated freeway, 5 = freeway on-ramp.
13	23	Presence on the L.A. Freeway 42 Mile Loop Range 0-1, units class	0 = no, 1 = yes
14	24-27	Loop Traffic Volume in Forward Direction Range 0-8422 units vehicles per hour	Hourly traffic volume taken by the nearest available counter in the same direction as the vehicle. This is real-time information taken from the computer system.
15	28-31	Loop Traffic Volume in Opposite Direction Range 0-7592 units vehicles per hour	Same as above but for the opposing traffic.
16	32-33	Loop Traffic - Hourly Average Speed in Forward Direction Range 0-64, units mph	This information is taken from the real-time computer network
17	34-35	Loop Traffic - Hourly Average Speed in Opposite Direction Range 0-69, units mph	This information is taken from the real-time computer network

TABLE 2 (continued)

VARIABLES	COLUMNS	CONTENT	DESCRIPTION
18	36	Off Loop Traffic Data Source Range 0-2, units class	0 = unknown or unavailable, 1 = city or county, 2 = state
19	37-38	Surface Street Traffic Index, Same Direction Range 0-35, units class	For city and county data, hourly information is available for each direction at morning and afternoon peak commuter hours. For city/county we extracted the appropriate A.M. or P.M. peak hourly value and indexed the traffic according to the code presented in Table 3. For state highway data only the total (both traffic directions) maximum hourly volume is provided. Therefore, in column 37, 38 this total flow is provided according to the same traffic indexing table.
20	39	Surface Street Traffic Index, opposite direction Range 0-7, unit class	For city or county this is provided as described above for the same or forward direction. For state data (variable 18=2) this slot is left blank.
21	40-41	Street name Range 1-62, units number	A street name index was compiled to remove all uncertainty concerning the vehicle's location. This information is provided in Table 4.
22	42	Background CO Range 0-9, A, B, C units ppm in hexidecimal	Background CO mid-block $1/R^2$.
23	43-72	Interior CO concentration Range 0-99, units ppm	A block of up to 15 two digit concentrations for consecutive minutes from the block time.
24	73-102	Exterior CO concentration Range 0-99, units ppm	A block of up to 15 two digit concentrations for consecutive minutes from the block time.
25	103-132	Vehicle Speed Range 0-99, Units mph	A block of up to 15 two digit speeds for consecutive minutes from the block time.

TABLE 3. TRAFFIC INDEX. VARIABLE 19, COLUMN 37-38

Value	Count Range	Value	Count Range
0	0-500	19	9001-9500
01	501-1000	20	9501-10,000
02	1001-1500	21	10,001-10,500
03	1501-2000	22	10,501-11,000
04	2001-2500	23	11,001-11,500
05	2501-3000	24	11,501-12,000
06	3001-3500	25	12,001-12,500
07	3501-4000	26	12,501-13,000
08	4001-4500	27	13,001-13,500
10	4501-5000	28	13,501,14,000
11	5001-5500	29	14,001-14,500
12	5501-6000	30	14,501-15,000
13	6001-6500	31	15,001-15,500
14	6501-7000	32	15,501-16,000
15	7001-7500	33	16,001-16,500
16	7501-8000	34	16,501-17,000
17	8001-8500	35	>17,000
18	8501-9000		

TABLE 4. STREET INDEX. VARIABLE 21, COLUMNS 40-41

Value	Street Name	Value	Street Name
01	Avenue of the Stars	33	Wilshire Boulevard
02	Santa Monica Boulevard	34	San Gabriel River Freeway
03	San Diego Freeway	35	Robertson Boulevard
04	Hollywood-Ventura Freeway	36	Broadway
05	Tampa Avenue	37	Hill Street
06	Roscoe Boulevard	38	Vincent
07	Corbin Street	39	Lark Ellen
08	Parthenia Street	40	Pomona Freeway
09	Mason Avenue	41	Normandie
10	Fairfax Avenue	42	Rampart
11	Olympic Boulevard	43	Pico
12	Curson Street	44	San Pedro Street
13	Del Valle	45	Eighth Street
14	Western	46	Los Angeles Street
15	Ventura Boulevard	47	Third Street
16	Ventura Freeway	48	Melrose Avenue
17	Burbank Boulevard	49	Fourth Street
18	Hollywood Way	50	Central Avenue
19	Magnolia Boulevard	51	Artesia Boulevard
20	Pass Avenue	52	Marquardt
21	Verdugo	53	Artesia Freeway
22	Buena Vista	54	Alondra
23	Santa Monica Freeway	55	La Brea
24	Harbor Freeway	56	Long Beach Boulevard
25	Golden State-Santa Ana Freeway	57	La Cienega Boulevard
26	Montana	58	Avalon
27	Freeway On-Ramp	59	Hawthorne Boulevard
28	Sepulveda Boulevard	60	Anza
29	Gayley Avenue	61	190th Street
30	Sunset Boulevard	62	Florencce
31	Sycamore		
32	Beverly Boulevard		

TABLE 5. FIXED STATION DATA. 51 LINES OF DATA IN FORMAT (2I2, 8I3, 8(I3,I2), 2I5).

Column	Content	Discussion
1-2	Station Number Range 1-14, units number	The first eight stations are part of the regional air quality management district network. The final six were CALTRANS (California Transportation Agency) vans and did not have associated meteorological instruments. (Meteorological data for them was taken from the nearest station, which is station #1). Table 7 provides site locations.
4	Test Date Range 1-5, units number	1 = Monday October 1, 1979, 2 = Tuesday, October 2, 1979, etc.
6-7	Hourly Average CO Readings Range 1-15, units ppm	6-7 A.M.
9-10		7-8 A.M.
12-13		8-9 A.M.
15-16		9-10 A.M
18-19		3-4 P.M.
21-22		4-5 P.M.
24-25		5-6 P.M.
27-28		6-7 P.M.
30-31	Wind Direction Range 1-16, units classes	6-7 A.M. Wind direction classes shown in Table 6.
32-33	Wind Speed Range 1-11, units mph	
35-36	Wind Direction	7-8 A.M.
37-38	Wind Speed	
40-41		8-9 A.M.
42-43		
45-46		9-10 A.M.
47-48		
50-51		3-4 P.M.
52-53		
55-56		4-5 P.M.
57-58		
60-61		5-6 P.M.
62-63		
65-66		6-7 P.M.
67-68		

Fixed Station Data (continued)

Column	Content	Discussion
70-73	Monitoring Site Latitude Range 3491-4120 Units DMM.M Degrees Minutes	Same format as described for exposure data.
75-78	Monitoring Site Longitude Range 7540-8319 Units, DMM.M. Degrees Minutes	Same format as described for exposure data

Again the entry 99 has been utilized to denote data unavailability. Note that only certain days of data were available for sites 10-14. Meteorology for sites 10-14 was taken from site #1 data. Wind direction index corresponds to the following set.

TABLE 6. WIND DIRECTION CLASSES

DIR	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
DEG.	360	23	45	68	90	113	135	158	180	203	225	248	270	293	315	338
PTS.	16	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

TABLE 7. LOCATION OF MONITORING STATIONS

Station Number	Designation	Address
1	N. Main	1630 N. Main St., Los Angeles
2	N.W. Coastal	1535 S. Robertson, Los Angeles
3	S. Central	11220 Long Beach Bl., Lynwood
4	W. Valley	18330 Gault St., Reseda
5	S.W. Coastal	11408 La Cienega Bl., Lennox
6	E. Valley	228 W. Palm Ave., Burbank
7	Anaheim	1010 S. Harbor Bl.
8	Pico Rivera	3713-B San Gabriel River Pkwy.
9	Commerce	Eastern Avenue & Jilson St.
10	West Vernon	Grand Avenue & 43rd St.
11	Winter Garden	1277 Clela Ave., Montebello
12	Dennis Mennis Park	Lakewood Bl & Gallatin Rd.
13	Edith Unsworth School	Cedartree Rd. & Lindse Ave.
14	61st St. School	61st & Figueroa

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 T    EA   I   GF EWGPDE   U   U E EL FF EB C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C
  E    B   T   IO S E TW   M   M D DO VV  A 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
       R   U   TR   S YA   E   E F OO OO SC                                                                E E E E E E E E E E E E E E E
       E   D   UT   T PY   F   O O PP LL TK I I I I I I I I I I I I I I I I I I I I E E E E E E E E E E E E E E E D D D D D D D D D D D D D D D
       A   E   D    O E    O   P R P  FO  G M M M M M M M M M M M M M M M M X X X X X X X X X X X X X X X
       K       E    M      R   P      OP  R T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T
*-*****-*****-----*---*-*-*----*****---**-**-**-**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**
14 4380354180354493204O   0   0 0 022302521113 311 9 0 0 0 0 0 0 0 0 0 811 5 9 6 0 0 0 0 0 0 0 0 0 0 04135204453 0 0 0 0 0 0 0 0 0 0 0
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```

| DR AO YU T E | TD IA MT EA | L A T I D E | LC OO MM GF IO TR UT D | LFCSRF ALOTOR KONOAE EWGPDE S E TW S YA T PY O E N | V O L U M E F O P R | V S SO TT KC AO M EB VV A DO OO SC MD EF EL FF OO TK GM RT | 1 2 3 4 5 6 7 8 9 0 C C C

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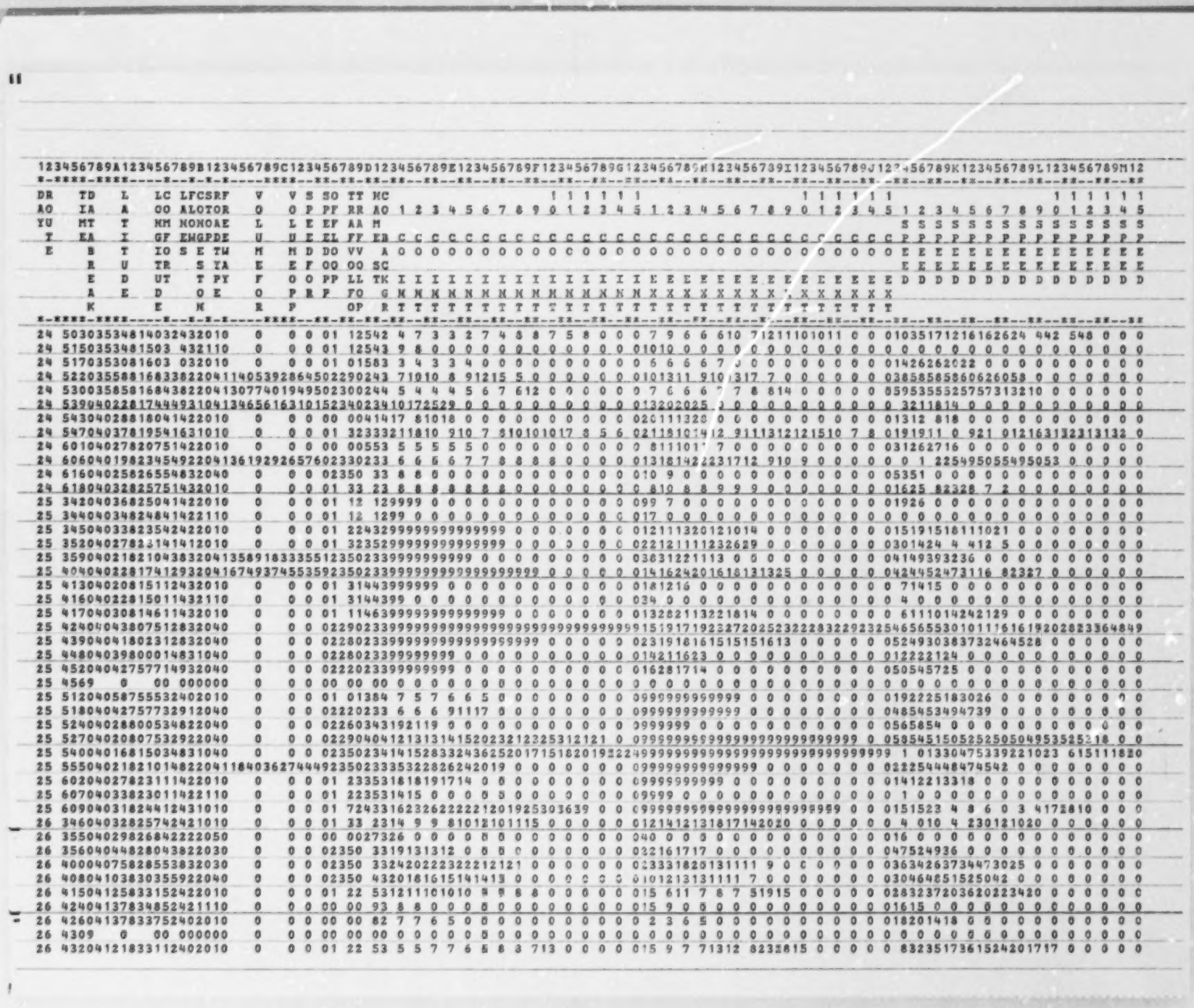

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DR   TD   L   LC LFCSRF   V   V S SO TT NC                1 1 1 1 1 1                1 1 1 1 1 1                          1 1 1 1 1 1
AO   IA   A   OO ALOTOR   O   O P PF RR AO 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5
YU   MT   T   MM MONOAE   L   L E EF AA M                                                                S S S S S S S S S S S S S S
 T   EA   I   GF EWGPDE   U   U E EL FF EB C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C
  E   B   T   IO S E TW   M   M D DO VV  A O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O
      R   U   TR   S YA   E   E F OO OO SC                                                                E E E E E E E E E E E E E E
      E   D   UT   T PY   F   O O PP LL TK I I I I I I I I I I I I I I I I I I I E E E E E E E E E E E E E E E E E E E E E E E E E E E E E E
      A   E   D    O E    O   P R P  FO  G N N N N N N N N N N N N N N N X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X
      K       E    K      R   P       OP  R T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T
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 32 9240403181851 42201O   0   0 0 0 01 1411719181621262 2 0 0 0 0 0 0 0 0 0 0 0 0221917222518 0 0 0 0 0 0 0 0 0133628193837 0 0 0 0 0 0 0 0 0
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*-*****-*****-----*--*-*-*-----*****--**-**-**-**-**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**
DR   TD   L   LC LFCSRF   V   V S SO TT NC                   1 1 1 1 1 1                   1 1 1 1 1 1                   1 1 1 1 1 1
AO   IA   A   OO ALOTOR   O   O P PF RR AO 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5
YU   MT   T   MM MONOAE   L   L E EF AA M                                                                 S S S S S S S S S S S S S S
 T   EA   I   GF EWGPDE   U   U E EL FF EB C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C P P P P P P P P P P P P P P
  E    B   T   IO S E TW   M   M D DO VV  A 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 E E E E E E E E E E E E E E
       R   U   TR   S YA   E   E F 00 00 SC                                                                 E E E E E E E E E E E E E E
       E   D   UT   T PY   F   O O PP LL TK I I I I I I I I I I I I I I I I I I I I I I E E E E E E E E E E E E E E D D D D D D D D D D D D D D
       A   E   D    O E    O   P R P  FO  G N N N N N N N N N N N N N N N N N N N N N N X X X X X X X X X X X X X X
       K       E    K      R   P      OP  R T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T
*-*****-*****-----*--*-*-*-----*****--**-**-**-**-**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**
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| DR AO YU T E | TD IA MT EA B | L A T I T | LC LFCSRF NM NONOAE GF EWGPDE IO S E TW TR S YA UT T PY D O E N E | V O L U M E O R | V O L F O P | S E E F E B | SO PF EF EL DO FO OP | TT RR AA FF VV GNNN

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                                                                                                                                                1 1 1 1 1 1
DR   TD   L   LC LFCSRF   V   V S SO TT NC                                1 1 1 1 1 1                                                          1 2 3 4 5 6 7 8 9 0 1 2 3 4 5
AO   IA   A   OO ALOTOR   O   O P PF RR AO 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 1 2 3 4 5
YU   MT   T   MM NONOAE   L   L E EF AA M                                                                                                  S S S S S S S S S S S S S S S
 T   EA   I   GF EWGPDE   U   U E EL FF EB C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C P P P P P P P P P P P P P P P
E        B   I   IO S E TW   M   M D DO VV  A O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O E E E E E E E E E E E E E E E
         R   U   TR   S YA   E   E F OO OO SC                                                                                                  E E E E E E E E E E E E E E E
         E   D   UT   T PY   F   O O PP LL TK I I I I I I I I I I I I I I I I I I I I E E E E E E E E E E E E E E E E E E D D D D D D D D D D D D D D D
         A   E   D    O E    O   P R P  FO  G N N N N N N N N N N N N N N N N N N N N X X X X X X X X X X X X X X X X X X
         K       E    N      R   P      OP  R T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T
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DR   TD   L   LC LFCSRF   V   V S SO TT NC                    1 1 1 1 1 1                    1 1 1 1 1 1                          1 1 1 1 1 1
AO   IA   A   OO ALOTOR   O   O P PF RR AO 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5
YU   MT   T   MM MONOAE   L   L E EF AA M                                                                S S S S S S S S S S S S S S
 T   EA   I   GF EWGPDE   U   U E EL FF EB C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C C P P P P P P P P P P P P P P
 E    B   T   IO S E TW   M   M D DO VV  A O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O O E E E E E E E E E E E E E E
      R   U   TR   S YA   E   E F OO OO SC                                                                      E E E E E E E E E E E E E E
      E   D   UT   T PY   F   O O PP LL TK I I I I I I I I I I I I I I I I I I I I I I I I I I I I I I I I I I I I D D D D D D D D D D D D D D
      A   E   D    O E    O   P R P  FO  G N N N N N N N N N N N N N N N N N N N N N N N N N N N N N N N N N N N
      K       E    M      R   P       OP  R T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T T
*-*****-*****----*--*-*-*----*****--**-**-**-**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**--**
 43 838040558210214020 0   0 0 0 01 22 2A282624 0 0 0 0 0 0 0 0 0 0 0 0 0262419 0 0 0 0 0 0 0 0 0 0 0 0 0182616 0 0 0 0 0 0 0 0 0 0 0 0 0 0
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DR AO YU T E	TD IA MT EA B	L A T I T	LC LFCSRF 00 ALOTOR MM NONOAE GF EWGPDE IO S E TW TR S YA UT T PY D O E N	V O L U M E F O R	V S SO TT NC O P PF RR AO L E EF AA M U E EL FF EB M D DO VV A E F 00 00 SC O O PP LL TK P R P FO G R	1 2 3 4 5 6 7 8 9 0 C C C C C C C C C C C O O O O O O O O O O O I I I I I I I I I I I T T T T T T T T T T T	1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 C C C C C C C C C C C O O O O O O O O O O O N N N N N N N N N N N T T T T T T T T T T T	1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 C C C C C C C C C C C O O O O O O O O O O O X X X X X X X X X X X T T T T T T T T T T T	1 2 3 4 5 S S S P P P E E E D D D	1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 S S S S S S S S S S S P P P P P P P P P P P E E E E E E E E E E E D D D D D D D D D D D	1 2 3 4 5 S S S S S S S S S S S P P P P P P P P P P P E E E E E E E E E E E D D D D D D D D D D D
45	45704041809012931040	0	0 0 0228023315151516	0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	014132222	0 0 0 0 0 0 0 0 0 0 0	016142248
45	50104043806532922040	0	0 0 0 0229023327231514 1312	0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0282111121210	0 0 0 0 0 0 0 0 0 0 0	0535352514947
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45	51404028800534812040	0	0 0 0 022603431010	5	8 8 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	012 9 6 7 9	0 0 0 0 0 0 0 0 0 0 0	05657515652
45	51904020807532822040	0	0 0 0 0229040310131517 1811111211	8	6 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	913141511	8 1 0 1 0 8 6 6 0 0 0	0484951565549575556 5048
45	53004014814532822040	0	0 0 0 02350232	9	1 4 1 1 1 4 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	010131012	0 0 0 0 0 0 0 0 0 0 0	051544730
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45	54004022822634822041375817584661233023212017171313141311111615		0 0		0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0191914151111112 10	9 1 0 1 4 1 4 0 0 0	0293340393641414430414740
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45	55404032825732422010	0	0 0 0 01 33 2322141619151720	0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0211213171119 14	0 0 0 0 0 0 0 0 0 0 0	02316202418 6 7
46	40204032825752421010	0	0 0 0 01 33 23 8 8 8 8 8 8	0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	81213 5 8	0 0 0 0 0 0 0 0 0 0 0	0 5 31813 4
46	40704070828955922030	0	0 0 0 02350 32 8 8 3 8 8 8 9	9	1 0 1 0 1 0 1 1 1 1 1 1 1	1 0 1 5 1 2 1 3 1 5 2 1 1	7 1 6 1 4 1 5 2 3 1 3	9 1 4 1 4	0134546393537443834444623153 1	0	0475351494745
46	42104103830352922040	0	0 0 0 02350 42111111111111	1	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0121111121010	0 0 0 0 0 0 0 0 0 0 0	0174110
46	42704107833151412010	0	0 0 0 01 22 52111112	0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	016 7 5	0 0 0 0 0 0 0 0 0 0 0	0392933293431
46	43004125833111412010	0	0 0 0 01 22 52111111	8	6 5 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	014 5 4 4 6	4 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0
46	43604137833711412110	0	0 0 0 01 11 72	5	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 4 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0
46	43704137833912412010	0	0 0 0 00 00 8213	9	5 3 5 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	014 4 3 3	8 0 0 0 0 0 0 0 0 0 0	02932103929
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46	44304116833111422010	0	0 0 0 01 22 52 8	9	1 6 1 1 1 5 1 6 1 6	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	8182711103015 19	0 0 0 0 0 0 0 0 0 0 0	03223343318252927
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46	45204103830312922040	0	0 0 0 02350 43131010	8	8 8 8 7 9 1 3 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	012 9 1 2	8 8 9 9 7 1 5 1 6 0 0 0	0 0 0 0 0 0 0 0 0 0 0
46	50204094825033832040	0	0 0 0 02320 4310	5	8 6 6 7 7 6 8 8 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	7 6 1 0	6 7 7 8 7 9 1 0 0 0 0 0	0462742465052504441 47
46	51204073820334822040	0	0 0 0 02340 43	8	8 8 8 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	9 8 1 0	0 0 0 0 0 0 0 0 0 0 0	0535333
46	51504055818532422010	0	0 0 0 01 22143 910	0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	01113	0 0 0 0 0 0 0 0 0 0 0	01411
46	5179 0 00 000000	0	0 0 0 00 00 00	0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	011	0 0 0 0 0 0 0 0 0 0 0	025
46	52504046818532422010	0	0 0 0 01 22143	9	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	013	0 0 0 0 0 0 0 0 0 0 0	1 0
46	52604042818532432110	0	0 0 0 01 2214313	0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	013	0 0 0 0 0 0 0 0 0 0 0	2121112
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46	53104038818542432010	0	0 0 0 01 12143	8	8 9 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	9 814	0 0 0 0 0 0 0 0 0 0 0	0 4 0
46	53404032818542431110	0	0 0 0 01 23143	9	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	013	0 0 0 0 0 0 0 0 0 0 0	028 9161720
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46	54004022817543931041666436235613 0 00232		4	81210	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	3 81610	0 0 0 0 0 0 0 0 0 0 0	0461814121014122123111415 33
46	54404044814041631040	0	0 0 0 02220243	8	9 912 7 8	8 1 9 1 3 1 5 1 9 1 7 1 7	0 0	8 1 1 1 5 1 0	6 7 7 2 0 1 2 1 6 1 9 1 8 1 9	0	0515355585654556 0
46	55704068816052922040	0	0 0 0 02290253	7	5 4 4 4 5 5 5 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 6 4 3 4 6 7 7 6 0 0	0 0 0 0 0 0 0 0 0 0 0	0605855523046464346494639	0 0 0	
46	60504092819553822040	0	0 0 0 00 00163	5	5 5 6 6 6 6 6 7 7 7 7	0 0 0 0 0 0 0 0 0 0 0	6 6 7 5 9 1 1 9 9 1 0	9 1 0 9 0 0 0	0515145525352525495145	0 0 0 0 0	
46	61704070828952922030	0	0 0 0 02340 33	8	8 8 9 1 0 1 0 1 0 1 0	9 9 0 0 0 0 0 0 1 1 1 5	2 1 9 8 8 7 7 5 4 0 0	0 0 0 0 8 0 0 0 0 0 0			
46	62704028826751422010	0	0 0 0 01 33 23	9	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 5 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 1 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	
46	62804029826651422110	0	0 0 0 01 33 23	9	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 5 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	03031	0 0 0 0 0 0 0 0 0 0 0	
46	62904031826851422010	0	0 0 0 00 00283	9	9 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 7 4 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0505046404230	0 0 0 0 0 0 0 0 0 0 0	
51	70504000824552832041384740944546232 0		3	9151618192021	0 0 0 0 0 0 0 0 0 0 0	0 1 2 1 1 1 2 1 2 1 4 1 8	4 2 5 1 9 1 9 1 6 2 5 2 2 2 7 2 3 2 4 1 7 1 4 1 7 1 8 4 4 4 0 5 0 4 4 4 5 4 6 4 3 4 4 1 9 3 8 4 0 4 6 4 6 3 0 1 8		
51	71104021821053832041471520816147235023822232425262728293133343535353413412151919162522272324171417184440504445464344193840464630 18										
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51	73004030815011422010	0	0 0 0 01 1049726242024	0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0	014131217	0 0 0 0 0 0 0 0 0 0 0	024161618
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123456789A123456789B123456789C123456789D123456789E123456789F123456789G123456789H123456789I123456789J123456789K123456789L123456789M12
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DR AO YU T E	TD IA MT EA B	L A T I T	LC MM GF IO TR UT O	LFCSRF MONOAE EWGPDE S E TW S YA T PY E	V O L U M E F	V S SO TT NC O P PF RR AQ M L E EF AA M U E EL FF EB M D DO VV A E F OO OO SC F O O PP LL TK R P R P FO G R	1 2 3 4 5 6 7 8 9 0	1 2 3 4 5 1 2 3 4 5 6 7 8 9 0	1 2 3 4 5 1 2 3 4 5 6 7 8 9 0	1 2 3 4 5	1 2 3 4 5 S S S S S P P P P P E E E E E D D D D D
51	7410400080881283204O		0 0 0	0224025922282523242324161821	0	0 0 0 0	0 2 0 1 8 1 6 1 3 1 2 1 3 1 1 1 3 1 6 1 7	0 0 0 0	0 5 0 5 0 4 8 4 0 4 4 5 0 5 0 5 4 5 2 5 4	0 0 0 0 0
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51	8039 0 00 000000		0 0 0	00 00 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	6 8 8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0	0 4 0 4 0 4 0	0 0 0 0 0
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51	8380353481503141211O		0 0 0	01 1154815	0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 1 1	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 3 8 6 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0
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51	9190355982214382204	1124311	1040532330	3510 8	9	1 1 1 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	7 5 5 7 7 7 7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 4 5 4 5 0 5 4 8 4 6 4 0	0 0 0
51	9269 0 00 000000		0	0 0 0 00 00 00 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 8 7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 1 2 2 5 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0
51	9340357782254242201O		0	0 0 0 00 0062313	8	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 2 7 1 7 1 7 1 8 1 8 1 6 1 8	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 1 0 2 5 1 5 3 3 1 2 3 5 1 8	0 0 0
52	7190403382355241201O		0	0 0 0 01 12439272618161615150	0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 2 7 1 7 1 7 1 8 1 8 1 6 1 8	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 1 0 2 5 1 5 3 3 1 2 3 5 1 8	0 0 0
52	7269 0 00 000000		0	0 0 0 00 00 00 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 3 4 3 8 3 5 4 1 4 8	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 9 4 0 2 0 1 4 1 3	0 0 0
52	7310402782315141201O		0	0 0 0 01 233592918171717	0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 4 4	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 2 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0
52	7360401982345122205O		0	0 0 0 00 0027918	0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 4 4	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 3 2 1 5 2 9 2 8 6 2 6 2 6 2 9	0 0 0
52	7370402182105383104147152081473523502381920212122232425				0	0 0 0 0 0 0	0 4 4 3 6 4 8 4 6 4 2 4 8 3 7 4 5	0 0 0 0 0 0 0	0 3 0 4 0 4 2 4 4 5 0 5 0 3 2	0 0 0
52	7450402281741293204184223946526123502372628405051433S				0	0 0 0 0 0 0	0 5 1 5 1 5 1 5 1 4 6 4 1 4 6	0 0 0 0 0 0 0	0 1 0 1 6 1 6	0 0 0
52	7520402081521142201O		0	0 0 0 01 32447332435	0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 3 9 4 1 4 4	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0
52	7550402281501142211O		0	0 0 0 01 3244735	0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 4 8	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 1 3 1 3 1 6 1 3 1 6 1 2	0 0 0
52	7560402881481242201O		0	0 0 0 01 104694036302523170	0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 4 5 4 0 3 5 4 0 2 9 2 6	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 2 5 5 4 5 1 5 1 5 3 5 7 5 8 5 8 5 5 5 7 5 5 5 6 5 7	0 0 0
52	8020402380501291204O		0	0 0 0 02290235162022201617171617181718158	0	0 2 7 2 9 2 8 2 4 2 4 2 5 2 3 2 3 2 4 2 3 2 4 2 1 1 8	0 1 8 1 9 2 0 1 9 1 8 1 9 2 0	0 0 0 0 0 0 0 0	0 5 8 5 0 6 0 5 9 5 6 5 4 5 0	0 0 0
52	8150404075902382204O		0	0 0 0 02260236121214161514140	0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 1 8 1 8 2 4 2 2 2 0 2 0 1 8	0 0 0 0 0 0 0 0	0 1 8 3 1 2 8 2 7 2 9 3 5 1 7	0 0 0
52	8220405675552241201O		0	0 0 0 01 00387151315191916150	0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 3 0 2 6 2 3 0 0 0 0 0 0 0 0 0 0	0 0 0
52	8299 0 00 000000		0	0 0 0 00 00 00 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 1 3 1 3 1 6	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 1 3 2 4 3 2	0 0 0
52	8360405675552241201O		0	0 0 0 01 00387 8	8	1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 1 3 1 4 1 5	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 5 5 5 5 5 5 5 5 4 1 5 8 5 3 5 1	0 0 0
52	8390405075553141201O		0	0 0 0 01 01386121112	0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 1 9 1 8 1 6 1 7 2 0 1 9 1 8 2 1	0 0 0 0 0 0 0 0	0 5 5 5 5 5 5 5 4 1 5 8 5 3 5 1	0 0 0
52	8420403980003382204O		0	0 0 0 02280235122013131515111190	0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 1 8 1 8 1 9 1 7 1 9 2 1 1 6 1 8 2 1 1 9 1 8 1 8	0 0 0 0 0 0 0 0	0 5 8 5 7 5 7 5 6 5 1 5 6 5 3 4 9 5 5 5 5 5 5 5 5 0	0 0 0
52	8500402080753382204O		0	0 0 0 02290405141314141316131017151312	0	0 0 0 1 8 1 8 1 9 1 7 1 9 2 1 1 6 1 8 2 1 1 9 1 8 1 8	0 0 0 0 0 0 0 0	0 3 6 4 4 3 4 4 1 5 2 5 2 5 6 5 6 5 6 5 7 5 5 5 1	0 0 0
52	9020402182003293204150922823495923502351113243134292120161614140				0	0 0 0 1 8 2 2 3 1 3 5 4 1 3 2 2 9 2 3 2 0 2 3 2 4 2 4	0 0 0 0 0 0 0 0	0 3 6 4 4 3 4 4 1 5 2 5 2 5 6 5 6 5 6 5 7 5 5 5 1	0 0 0
52	9140402782313142201O		0	0 0 0 01 3235513161620140	0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 2 4 2 1 2 0 2 6 1 9	0 0 0 0 0 0 0 0	0 2 8 1 8 1 7 3 1	0 0 0
52	9190403182443243201O		0	0 0 0 01 33435141517251915232113	0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 1 8 1 8 3 2 3 2 6 1 7 2 2 9 1 6 1 7	0 0 0 0 0 0 0 0	0 8 2 1 2 3 3 0 2 1 1 6 2 5 9 8 0 0 0 0 0 0	0 0 0
53	7000403682675241201O		0	0 0 0 00 00295 6 6 6 6 6	0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 5 6 7 7 9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0	0 1 7 3 5 1 6 1 5 4 0	0 0 0
53	7050406782885292203O		0	0 0 0 02350 36 6 6 6 7 7 7 8 9	9	1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 1 0 8 9 1 2 1 6 1 4 1 8 1 7 1 5 1 6 1 5	0 0 0 0	0 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	0 0 0
53	7160410383035492204O		0	0 0 0 02350 391111111112	0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 1 5 1 5 1 5 1 2 1 1	0 0 0 0 0 0 0 0	0 5 0 4 7 4 7 4 4 2 8	0 0 0

123456789A	123456789B	123456789C	123456789D	123456789E	123456789F	123456789G	123456789H	123456789I	123456789J	123456789K	123456789L	123456789M	12
DR TD L LC LFCSRF V V S SO TT NC 1 1 1

APPENDIX B. FIXED SITE DATA

STATE	DATE	CO 6-7	CO 7-8	CO 8-9	CO 9-10	CO 3-4	CO 4-5	CO 5-6	CO 6-7	IP/RE/CD 7-8	IP/RE/CD 7-8	IP/RE/CD 8-9	IP/RE/CD 8-9	IP/RE/CD 9-10	IP/RE/CD 9-10	IP/RE/CD 3-4	IP/RE/CD 3-4	IP/RE/CD 4-5	IP/RE/CD 4-5	IP/RE/CD 5-6	IP/RE/CD 5-6	IP/RE/CD 6-7	IP/RE/CD 6-7	LAT	LONG
1	1	6	4	3	4	2	2	2	1	2	3	2	3	9	2	10	3	10	6	11	7	12	7	11	7	4020	8157
1	2	5	5	5	5	3	3	3	4	1	4	2	4	1	4	11	2	12	8	12	7	13	5	13	2	4020	8157
1	3	9	9	9	6	4	5	3	3	2	1	2	9	9	2	2	10	2	12	4	11	4	10	4	11	3	4020	8157
1	4	10	11	8	5	2	2	2	3	2	2	2	2	15	3	3	2	11	10	11	9	11	8	11	2	4020	8157
1	5	9	7	5	7	2	2	2	2	2	3	1	6	6	2	8	3	10	11	11	8	11	8	11	4	4020	8157
2	1	3	5	2	2	1	1	1	1	8	1	6	1	8	2	9	3	10	4	10	4	10	3	10	2	4031	8230
2	2	6	6	5	3	2	2	3	3	16	1	6	1	9	2	10	7	10	4	9	3	9	2	8	1	4031	8230
2	3	8	9	10	8	4	3	3	3	12	1	11	2	5	3	10	3	10	3	10	3	9	2	9	1	4031	8230
2	4	8	11	10	8	99	99	99	99	11	1	7	1	5	2	7	3	10	5	10	4	9	2	7	1	4031	8230
2	5	99	99	99	99	2	2	2	2	12	1	5	1	10	2	10	3	10	5	10	4	10	2	9	1	4031	8230
3	1	11	7	4	3	2	2	3	3	4	1	5	1	12	1	11	2	11	4	12	7	12	7	12	7	3557	8126
3	2	13	8	6	5	3	3	3	3	1	2	1	1	13	3	12	3	12	10	12	9	12	8	12	7	3557	8126
3	3	10	10	7	7	4	4	3	3	16	1	10	1	3	1	10	1	12	9	12	8	11	7	12	5	3557	8126
3	4	10	10	7	5	3	3	3	3	15	1	13	1	12	1	9	1	12	11	12	9	12	8	11	5	3557	8126
3	5	15	13	9	5	3	3	2	2	8	1	12	1	8	2	11	2	12	10	12	8	12	7	11	4	3557	8126
4	1	99	99	99	99	99	99	99	99	12	2	8	1	5	3	6	3	5	6	5	4	5	2	6	2	4120	8319
4	2	99	99	99	99	99	99	99	99	13	2	12	2	12	2	7	2	5	3	11	5	14	4	11	4	4120	8319
4	3	99	99	99	99	3	3	3	2	6	1	9	2	14	3	11	3	15	4	13	3	10	4	10	2	4120	8319
4	4	7	9	7	6	2	2	2	3	2	1	14	3	9	2	9	3	13	6	12	4	11	4	12	4	4120	8319
4	5	6	9	6	4	99	99	99	99	14	2	14	1	10	2	3	2	13	9	13	7	12	4	11	4	4120	8319
5	1	8	7	3	2	2	2	1	1	4	2	6	2	8	2	12	3	13	7	13	6	13	6	13	5	3558	8222
5	2	15	6	2	2	3	3	1	1	13	1	14	3	14	5	14	6	14	10	13	8	13	7	13	6	3558	8222
5	3	8	8	6	4	3	3	2	2	16	2	4	2	5	2	10	3	13	7	12	8	11	7	12	5	3558	8222
5	4	10	9	7	5	2	2	1	1	16	1	11	1	3	2	10	99	13	7	13	7	13	7	9	5	3558	8222
5	5	10	8	99	3	2	3	2	2	10	1	10	1	10	2	12	4	13	10	13	99	13	99	12	99	3558	8222
6	1	7	6	3	2	4	5	4	4	11	2	10	2	11	1	9	3	7	8	7	7	8	5	11	2	4110	8186
6	2	8	9	8	7	4	5	6	6	12	2	11	3	11	2	12	2	10	4	6	4	5	4	5	4	4110	8186
6	3	10	12	9	8	6	8	8	6	13	2	12	3	11	2	12	2	99	99	99	99	99	99	99	99	4110	8186
6	4	12	14	11	8	4	4	4	4	99	99	99	99	11	2	10	2	8	5	6	7	6	7	6	5	4110	8186
6	5	9	10	8	5	3	4	4	4	12	2	11	2	12	2	9	3	10	4	5	8	6	6	5	5	4110	8186
7	1	5	5	3	3	3	3	3	2	3	2	4	2	15	2	15	2	11	5	10	5	11	4	11	4	3491	7540
7	2	7	6	4	4	3	4	5	5	1	1	1	2	15	2	15	2	12	5	12	4	12	3	13	2	3491	7540
7	3	10	7	6	6	6	6	6	4	2	1	11	1	2	2	15	2	12	2	12	3	12	5	13	2	3491	7540
7	4	4	4	4	3	5	4	5	5	6	3	5	2	8	2	9	2	11	5	13	4	12	3	13	2	3491	7540
7	5	9	9	10	6	5	5	5	6	2	1	2	1	9	2	10	2	10	6	13	4	13	3	12	2	3491	7540
8	1	5	99	99	99	2	2	1	2	2	3	2	3	9	2	10	3	10	5	11	7	12	7	11	7	4008	8035
8	2	5	7	4	3	3	3	3	4	1	4	2	4	1	4	11	2	12	8	12	7	13	5	13	2	4008	8035
8	3	9	8	7	6	4	4	3	4	2	1	2	9	9	2	2	10	2	12	4	11	4	10	4	11	2	4008	8035
8	4	6	99	99	4	3	3	3	3	2	2	2	2	15	3	3	2	11	10	11	9	11	8	11	2	4008	8035
8	5	8	8	5	4	4	3	3	3	2	3	1	6	6	2	8	3	10	11	11	8	11	8	11	4	4008	8035
9	2	4	5	5	5	3	3	3	3	1	4	2	4	1	4	11	2	12	8	12	7	13	5	13	2	4001	8093
9	4	6	8	8	5	5	3	3	3	2	2	2	2	15	3	3	2	11	10	11	9	11	8	11	2	4001	8093
10	2	9	12	10	5	4	4	5	5	1	4	2	4	1	4	11	2	12	8	12	7	13	5	13	2	4003	8169
10	4	6	10	12	8	3	3	3	3	2	2	2	2	15	3	3	2	11	10	11	9	11	8	11	2	4003	8168
11	2	5	7	5	5	3	99	4	4	1	4	2	4	1	4	11	2	12	8	12	7	13	5	13	2	4009	8097
11	4	6	14	10	6	4	4	4	3	2	2	2	2	15	3	3	2	11	10	11	9	11	8	11	2	4009	8097
12	4	5	9	10	7	3	99	3	3	2	2	2	2	15	3	3	2	11	10	11	9	11	8	11	2	3574	8066
13	2	5	6	5	5	4	3	4	3	1	4	2	4	1	4	11	2	12	8	12	7	13	5	13	2	3574	8064
13	4	5	10	11	7	4	3	4	3	2	2	2	2	15	3	3	2	11	10	11	9	11	8	11	2	3574	8064
14	2	15	14	12	5	3	3	3	3	1	4	2	4	1	4	11	2	12	8	12	7	13	5	13	2	3591	8169
14	4	7	11	12	7	3	3	3	3	2	2	2	2	15	3	3	2	11	10	11	9	11	8	11	2	3591	8169

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APPENDIX C

Methods For Estimating One-minute Averages

One-minute averages were, in most cases, estimated by a five-point trapezoidal integration algorithm; where possible (or preferable), visual estimates were made. An acetate overlay was inscribed with three parallel lines corresponding to the end points and midpoint of a 1-minute (0.5-cm) interval on the strip charts. The overlay was placed over each minute interval, as shown in Figure C-1. Curve heights Y_A, Y_C, and Y_E were read at the intersections of the overlay lines and the strip chart trace. Values Y_B and Y_D were estimated visually as the height of the trace at the midpoints between the inscribed lines. The area under the trace was estimated as the sum of the areas of the four trapezoids thus defined:

$$\text{Area} = \frac{0.25\ (Y_A + Y_B)}{2} + \frac{0.25\ (Y_B + Y_C)}{2} + \frac{0.25\ (Y_C + Y_D}{2} = \frac{0.25\ (Y_D + Y_E)}{2}$$

$$\text{Area} = 0.125\ (Y_A + 2Y_B + 2Y_C + 2Y_D + Y_E)$$

In practice, values Y_A through Y_E were read and entered in order into a Texas Instruments SR-52 electronic calculator programmed to calculate areas by the above equation. The calculator was attached to a Texas Instruments PC-100A printer so that calculated estimates could be recorded immediately.

Visual estimates were made under two circumstances. First, in many cases curves were constant, monotonic or relatively invariant for as many as 30 minutes in a row, so that averages could be made by inspection. In other cases, the curves exhibited numerous maxima and minima within a single one-minute interval, so that it was difficult to designate heights

Y_{AE} through Y_E. For these cases, a horizontal line inscribed on the overlay was moved up and down until, in the analyst's judgment, equal areas of the curve were found above and below the line. The vertical position of the horizontal line on the strip chart was then considered the one-minute average value as shown in Figure C-2.

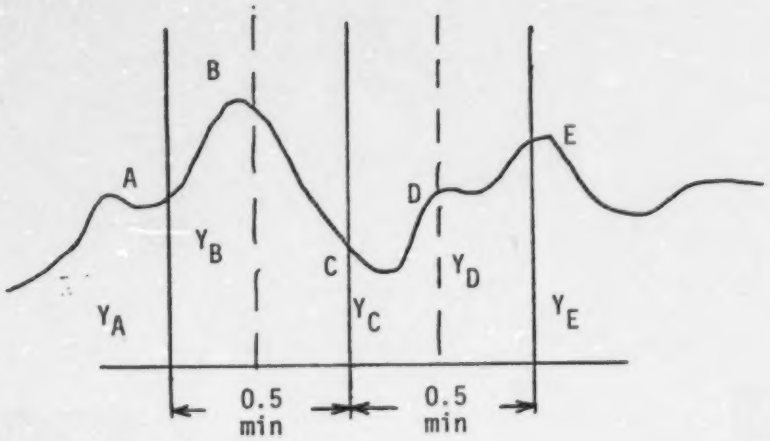


Figure C-1, Schematic of points for trapezoidal integration of one-minute traces.

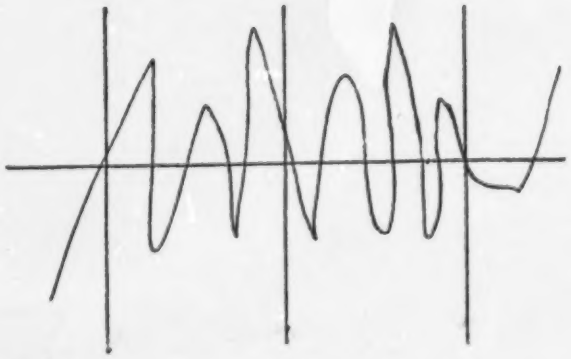


Figure C-2. Use of inscribed horizontal line to determine point dividing curve into equal areas.

To test the accuracy of our method for estimating one-minute averages from the strip chart traces, we compared these averages with those derived from planimeter measurements on the same strip charts. Some explanation of the latter is warranted. Our original method for data reduction and interpretation was to divide each test run into time intervals corresponding to different sets of test conditions (comfort state, position on freeway, etc.). Not all of these intervals were integral numbers of minutes. In addition, some "intervals" were actually points in time at which peak readings were to be taken off the strip chart. We analyzed two runs, (called runs 1 and 2) before switching to the method finally used. Measurements were made with a Los Angeles Scientific Instrument Company Model L-20AM polar compensating planimeter.

Before one-minute estimates were made by the final method, many of the above-mentioned intervals were substantially redefined. Thus the intervals used in the two methods frequently do not coincide. To compare results it was therefore necessary to assign minute-by-minute readings to each of the planimeter intervals. This was done conveniently in the case of Run 1. In Run 2, however, three problems arose. First, the planimeter interpretation contained three instantaneous peak values which could not be compared to one-minute averages. Second, three planimeter intervals consisted of fractions of a minute, so that it was not possible to find a correspondence between them and one-minute intervals. Finally, two planimeter intervals were only one minute long. Previous work with this particular device showed it to be accurate to ± 0.83 ppm CO or ± 1.66 miles per hour for the scale of strip chart used, if only one minute's trace was integrated. As the discussion below shows, these inherent instrument errors exceed the measurement error for about 87 percent of the intervals compared. We therefore ignored eight intervals (representing 27 out of 165 minutes) in this run.

Tables C-1 and C-2 show the average CO and speed for Runs 1 and 2, respectively, as measured by planimeter and by averaging one-minute estimates over each interval. Corrections due to zero drift have been made wherever applicable. It is clear that in the great majority of intervals, the carbon monoxide averages are within 1 ppm of the values

TABLE C-1. COMPARISON OF REPORTED READINGS WITH VALUES DERIVED FROM PLANIMETER MEASUREMENTS, RUN 1

Planimeter Interval	Interior CO, ppm			Exterior CO, ppm			Speed, mph		
	Plan. Value	Mean of 1-min Ests.	Δ	Plan. Value	Mean of 1-min Ests	Δ	Plan. Value	Mean of 1-min Ests.	Δ
1	8.4	8.2	-0.2	10.0	10.0	0	45.2	46.3	+1.1
2	9.5	9.0	-0.5	10.0	10.0	0	49.8	51.2	+1.4
3	8.2	8.3	+0.1	10.7	10.8	+0.1	26.6	29.4	+2.8
4	5.7	5.5	-0.2	7.8	8.0	+0.2	24.1	25.3	+1.2
5	7.7	7.8	+0.1	10.0	10.0	0	22.3	24.7	+2.4
6	8.2	8.5	+0.3	11.2	10.8	-0.4	9.4	9.2	-0.2
7	11.2	11.5	+0.3	13.9	14.3	+0.4	25.3	25.2	0
8	12.0	11.7	-0.3	13.6	13.6	0	22.8	21.0	-1.8
9	8.9	9.0	+-.1	11.5	11.9	+0.4	18.0	19.7	+1.7
10	17.4	17.5	+0.1	19.1	19.5	+0.4	22.0	23.2	+1.2
Mean Square Deviation			0.253			0.263			1.61

TABLE C-2. COMPARISON OF REPORTED READINGS WITH VALUES DERIVED FROM PLANIMETER MEASUREMENTS, RUN 2

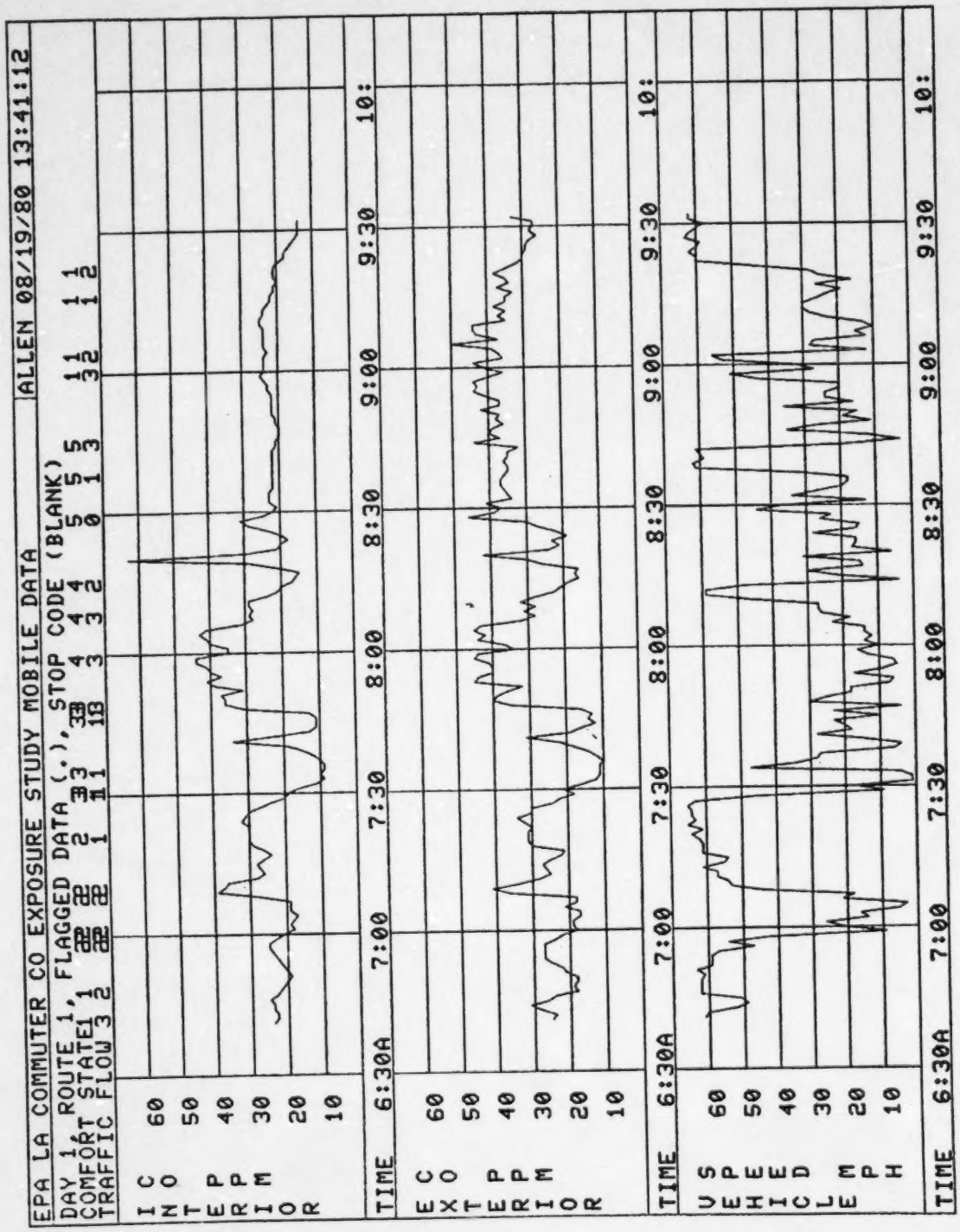
Planimeter Interval	Interior CO, ppm			Exterior CO, ppm			Speed, mph		
	Plan. Value	Mean of 1-min Ests.	Δ	Plan. Value	Mean of 1-min Ests	Δ	Plan. Value	Mean of 1-min Ests.	Δ
1	10.4	10.9	+0.5	10.1	9.6	-0.5	43.5	44.1	+0.6
2	10.4	10.6	+0.2	9.4	9.8	+0.4	13.1	12.9	-0.2
3	7.3	6.8	-0.5	6.7	6.5	-0.2	44.0	45.0	+0.1
8	5.0	4.8	-0.2	4.8	4.5	-0.3	23.5	22.2	-1.3
10	2.1	2.8	+0.7	5.3	5.0	-0.3	22.3	22.3	0
11	5.1	5.5	+0.4	4.8	4.5	-0.3	38.7	39.2	+0.5
12	9.5	10.0	+0.5	11.8	11.0	-0.8	21.6	22.5	+0.9
14	8.7	8.8	+0.1	5.8	7.3	+1.5	11.3	13.0	+1.7
16	8.3	8.0	-0.3	10.3	11.6	+1.3	17.3	17.2	-0.1
18	8.2	8.0	-0.2	4.9	5.3	+0.4	17.2	18.7	+1.5
19	7.5	7.8	+0.3	10.5	12.4	+1.9	13.9	14.6	+0.7
20	6.5	6.4	-0.1	4.2	4.6	+0.4	10.0	9.4	-0.6
21	13.0	15.8	+2.8	15.6	14.2	-1.4	17.9	18.0	+0.1
22	7.1	7.6	+0.5	7.5	8.4	+0.9	15.6	15.5	-0.1
23	5.4	5.5	+0.1	5.7	5.7	0	42.1	43.3	+1.2
24	15.1	13.5	-1.6	14.9	15.8	+0.9	29.9	28.8	-0.1
25	3.5	3.8	+0.3	3.7	3.2	-0.5	50.6	51.0	+0.4
26	5.1	5.1	0	5.9	6.0	+0.1	41.0	40.9	-0.1
27	15.1	14.5	-0.6	28.0	32.0	+4.0	9.1	8.5	-0.6
28	3.1	3.1	0	3.9	4.0	+0.1	25.5	22.3	-3.2
29	5.2	5.2	0	5.3	5.4	+0.1	35.3	35.5	0
30	5.4	5.3	-0.1	5.7	5.0	-0.7	45.9	43.3	-2.6
31	3.8	3.7	-0.1	4.6	5.1	+0.5	46.7	48.0	+1.3
Mean Square Deviation			0.747			1.14			1.18

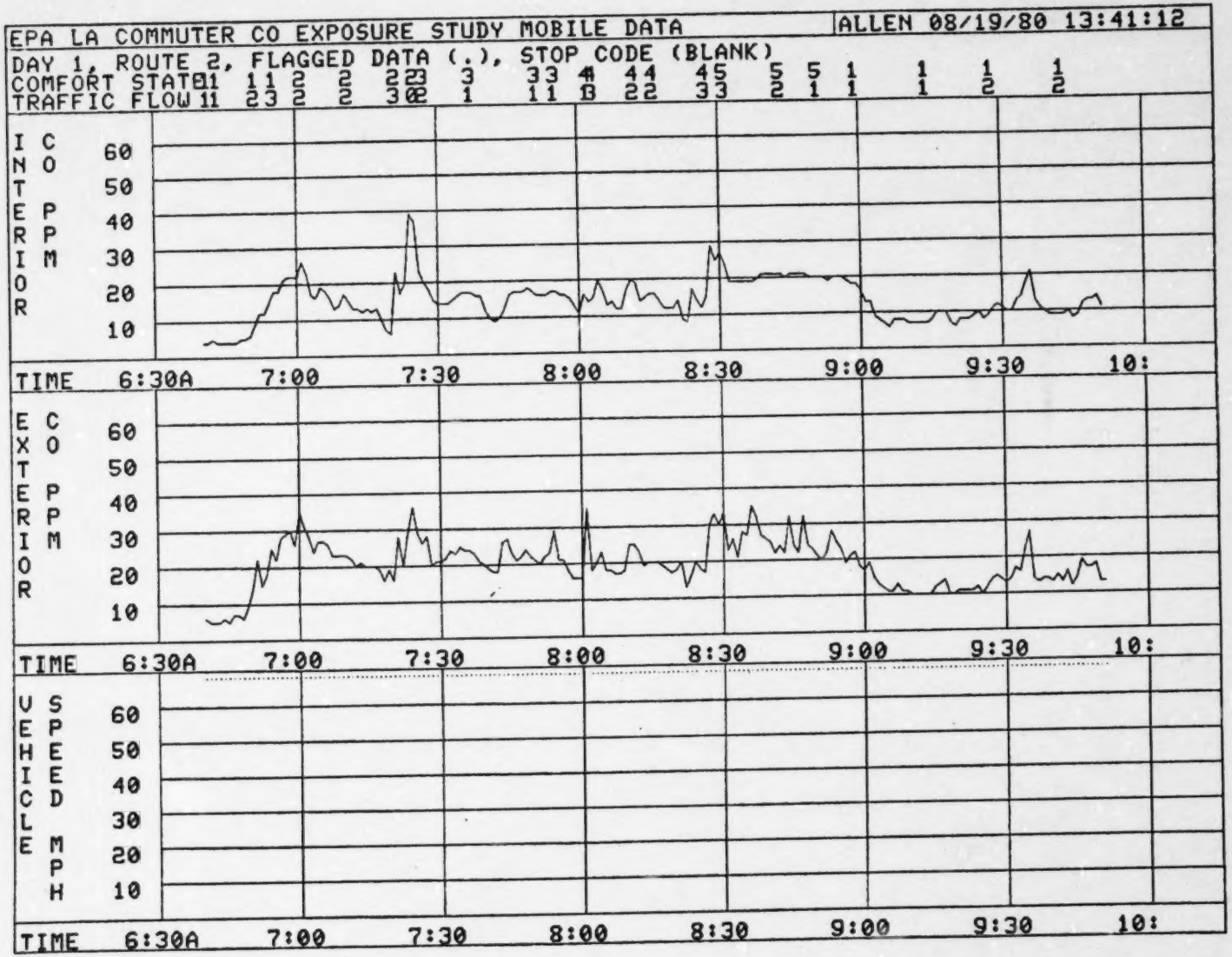
measured by planimeter. The mean square deviation $\sqrt{\frac{\Sigma\Delta^2}{N}}$ for the two types of measurement is below 1 ppm except for exterior CO in Run 2, in which a 4-ppm discrepancy accounts for most of the errors; in this case the instrument went off-scale (< 0,> 50 ppm) so that the reading, and any interpretation thereof, is questionable. The mean square deviation for the speed was less than 2 mph for both runs, which is remarkable, given the relative difficulty of estimating one-minute averages for "stop-and-go" traffic conditions.

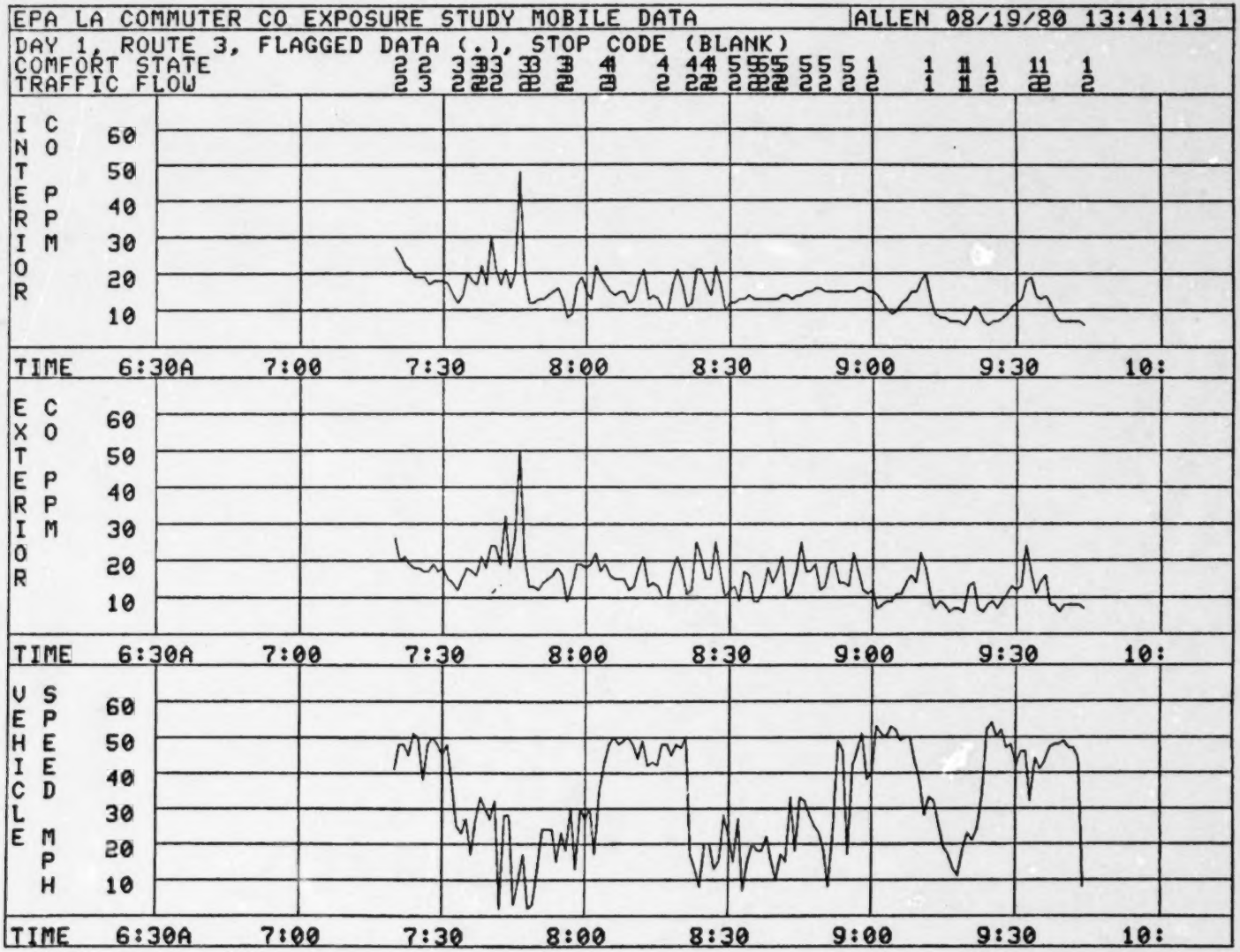
Given the inherent accuracy of the devices used to measure the physical phenomena, the strip chart recorder and the planimeter, we believe that the one-minute averages ultimately reported are within 1 to 2 ppm of the true CO values and within 2 to 3 mph of the true vehicle speed.

Appendix D

Graphical Display of Exposure Data


EPA LA COMMUTER CO EXPOSURE STUDY MOBILE DATA
ALLEN 08/19/80 13:41:12
DAY 1, ROUTE 1, FLAGGED DATA (.), STOP CODE (BLANK)
COMFORT STATE 1 1 2 3 3 3 3 4 4 4 5 5 5 11 1 1
TRAFFIC FLOW 3 2 2 2 2 1 1 1 1 3 3 2 0 1 3 3 2 1 2
INCOTEMP PPM OR
EXCOTEMP PPM OR
VEPHICLEMPH
TIME 6:30A 7:00 7:30 8:00 8:30 9:00 9:30 10:
60
50
40
30
20
10


EPA LA COMMUTER CO EXPOSURE STUDY MOBILE DATA
ALLEN 08/19/80 13:41:12
DAY 1, ROUTE 2, FLAGGED DATA (.), STOP CODE (BLANK)
COMFORT STAT 1 1 2 2 2 3 3 3 4 4 4 5 5 5 1 1 1 1
TRAFFIC FLOW 1 2 3 2 2 3 2 1 1 1 3 2 2 3 3 2 1 1 1 2 2
INTERIOR CO PPM
60
50
40
30
20
10
TIME 6:30A 7:00 7:30 8:00 8:30 9:00 9:30 10:
EXTERIOR CO PPM
60
50
40
30
20
10
TIME 6:30A 7:00 7:30 8:00 8:30 9:00 9:30 10:
VEHICLE SPEED MPH
60
50
40
30
20
10
TIME 6:30A 7:00 7:30 8:00 8:30 9:00 9:30 10:


EPA LA COMMUTER CO EXPOSURE STUDY MOBILE DATA
ALLEN 08/19/80 13:41:13
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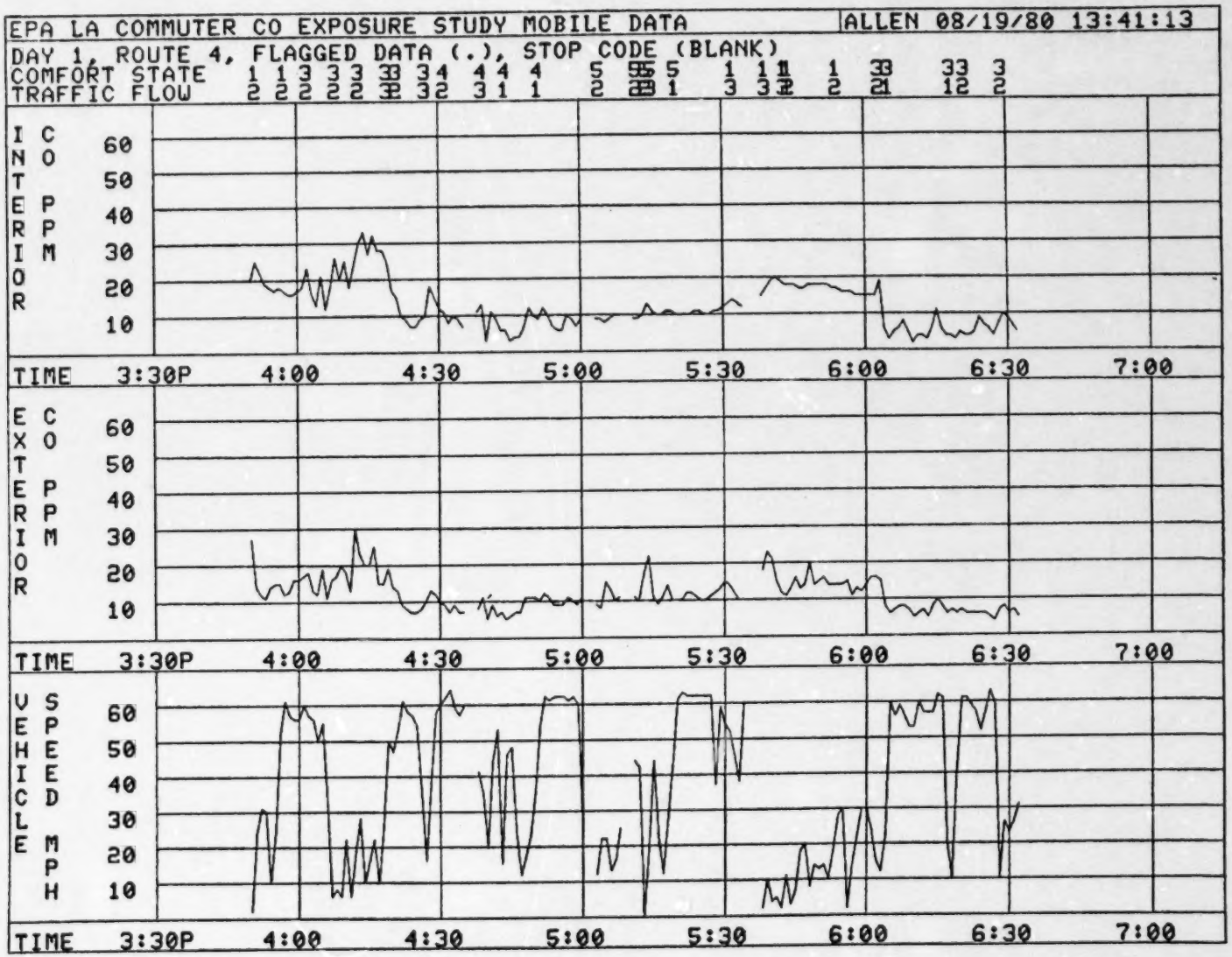
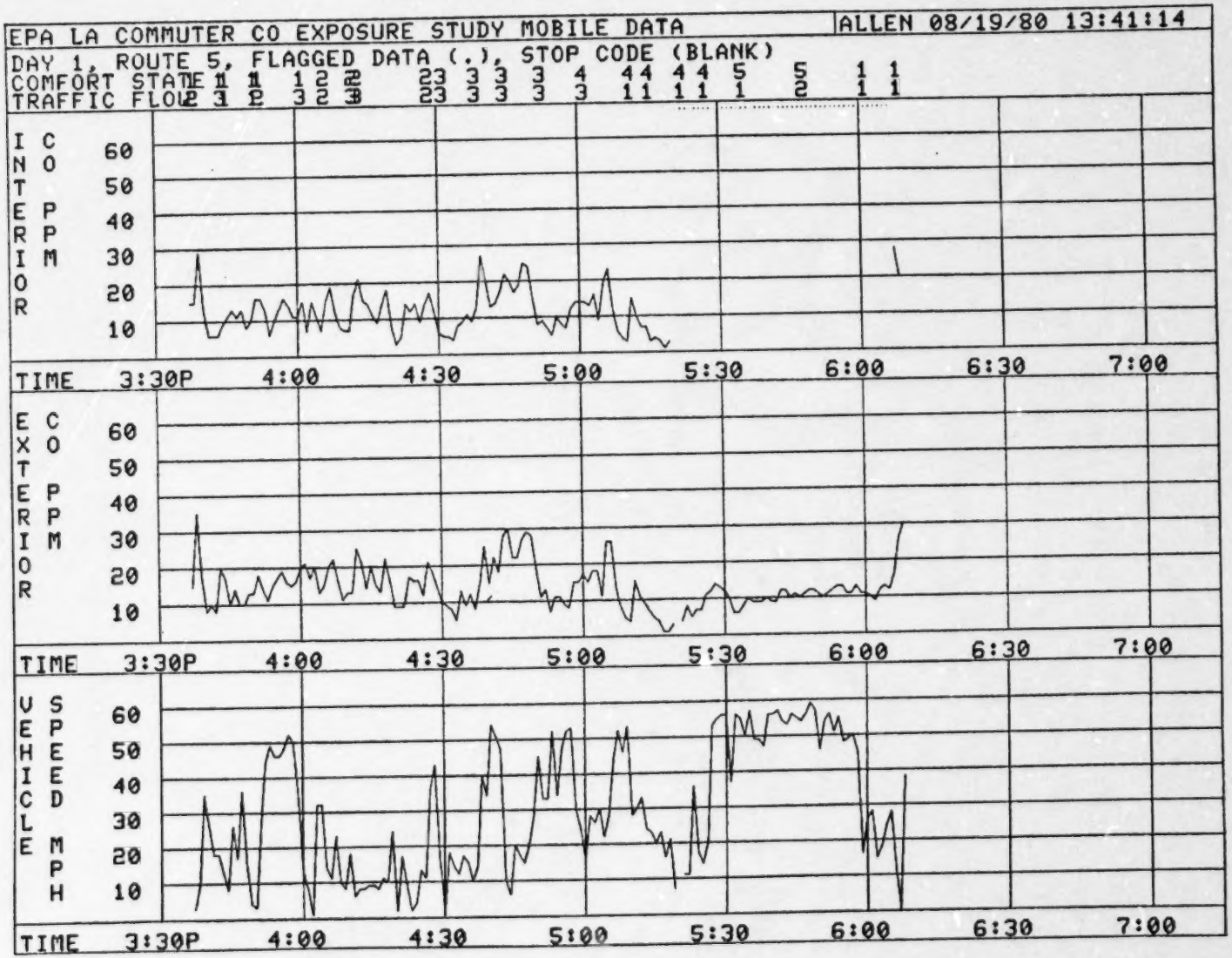
COMFORT STATE
TRAFFIC FLOW
INTERIOR CO PPM
EXTERIOR CO PPM
VEHICLE SPEED MPH
60
50
40
30
20
10
TIME 6:30A 7:00 7:30 8:00 8:30 9:00 9:30 10:


EPA LA COMMUTER CO EXPOSURE STUDY MOBILE DATA
ALLEN 08/19/80 13:41:13
DAY 1, ROUTE 4, FLAGGED DATA (.), STOP CODE (BLANK)
COMFORT STATE
TRAFFIC FLOW
INTERIOR CO PPM
EXTERIOR CO PPM
VEHICLE SPEED MPH
60
50
40
30
20
10
TIME 3:30P 4:00 4:30 5:00 5:30 6:00 6:30 7:00


EPA LA COMMUTER CO EXPOSURE STUDY MOBILE DATA
ALLEN 08/19/80 13:41:14
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COMFORT STATE
TRAFFIC FLOW
INTERIOR CO PPM
EXTERIOR CO PPM
VEHICLE SPEED MPH
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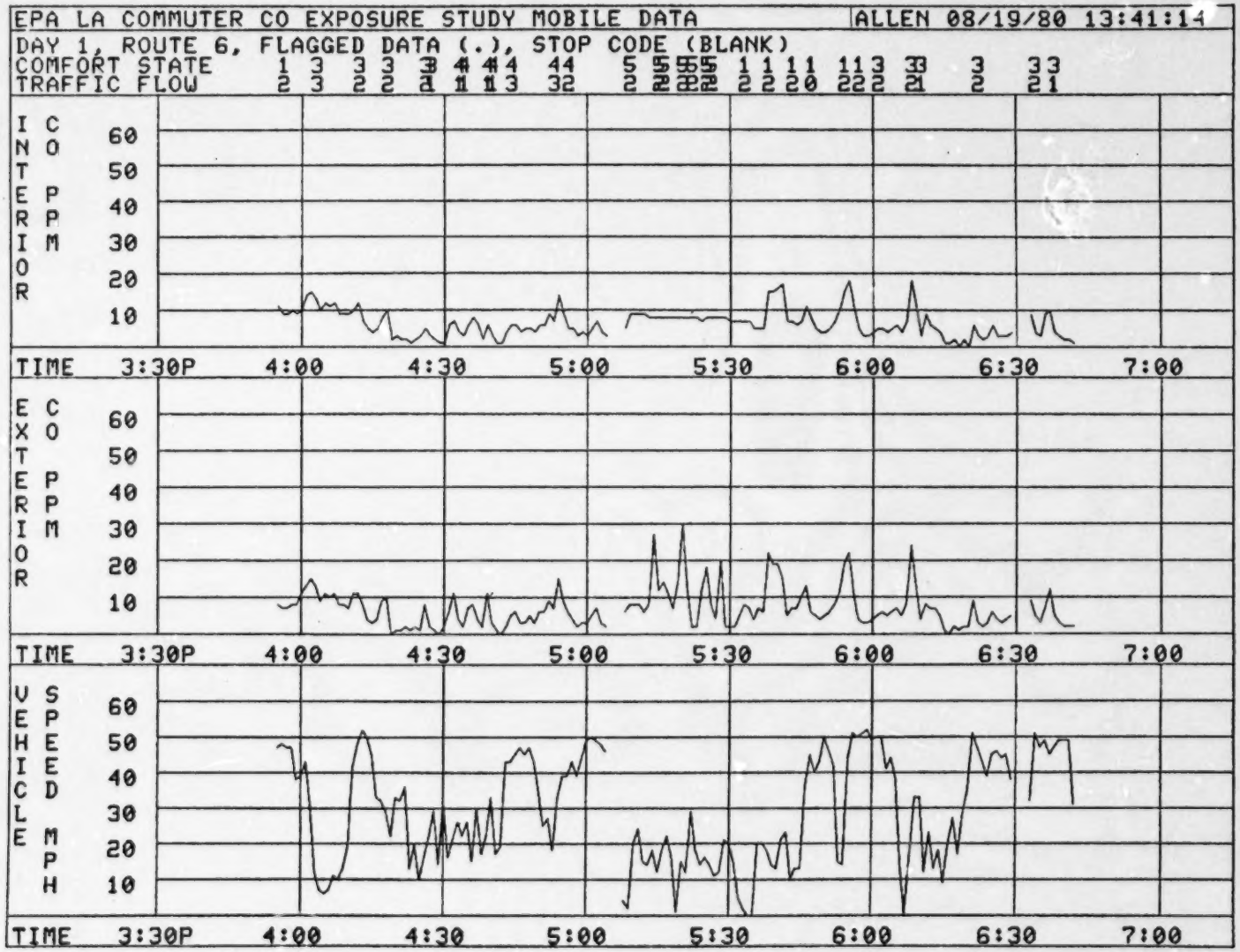
50
40
30
20
10
TIME 3:30P 4:00 4:30 5:00 5:30 6:00 6:30 7:00


EPA LA COMMUTER CO EXPOSURE STUDY MOBILE DATA
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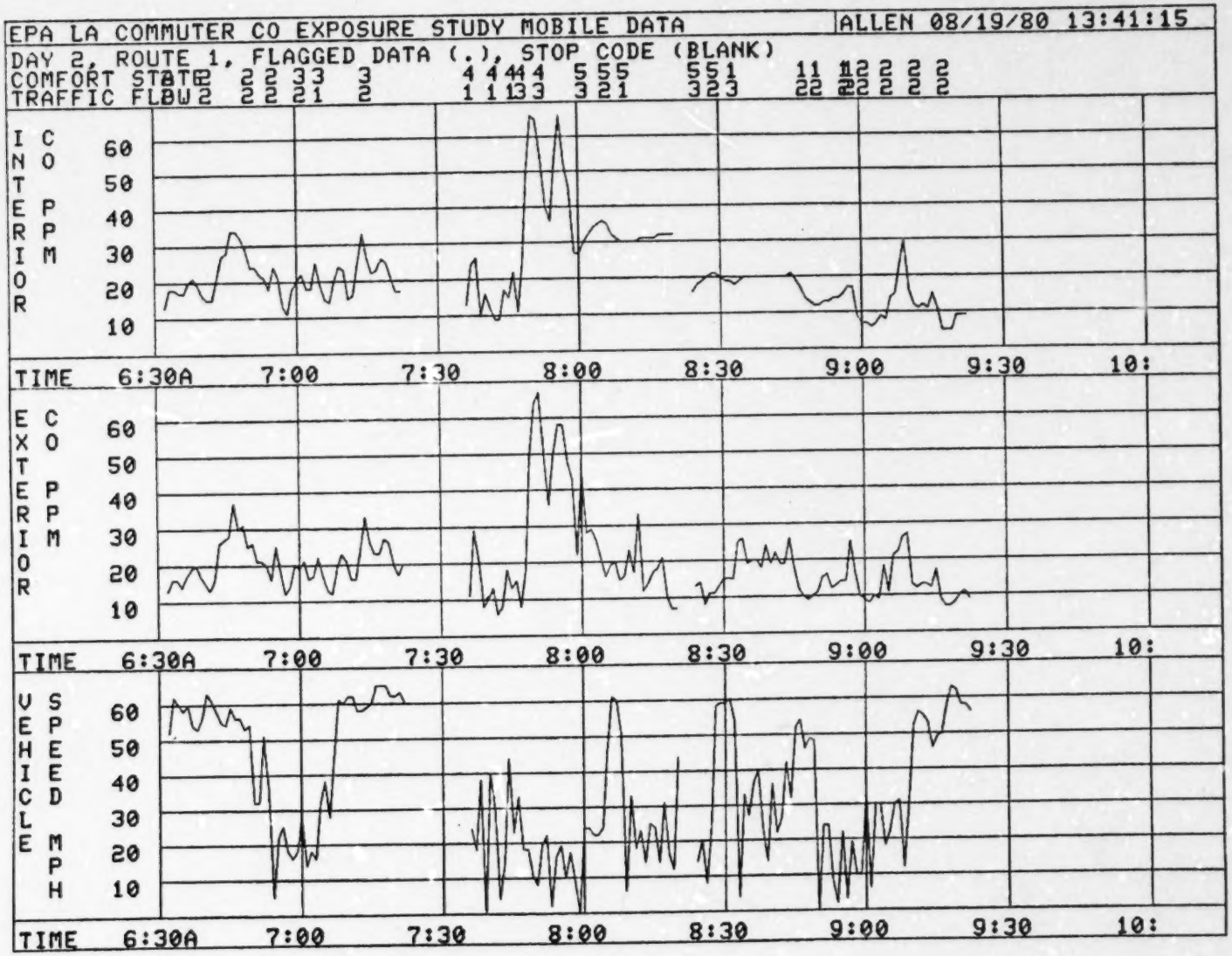
COMFORT STATE
TRAFFIC FLOW
INTERIOR CO PPM
EXTERIOR CO PPM
VEHICLE SPEED MPH
60
50
40
30
20
10
TIME 3:30P 4:00 4:30 5:00 5:30 6:00 6:30 7:00


EPA LA COMMUTER CO EXPOSURE STUDY MOBILE DATA
ALLEN 08/19/80 13:41:15
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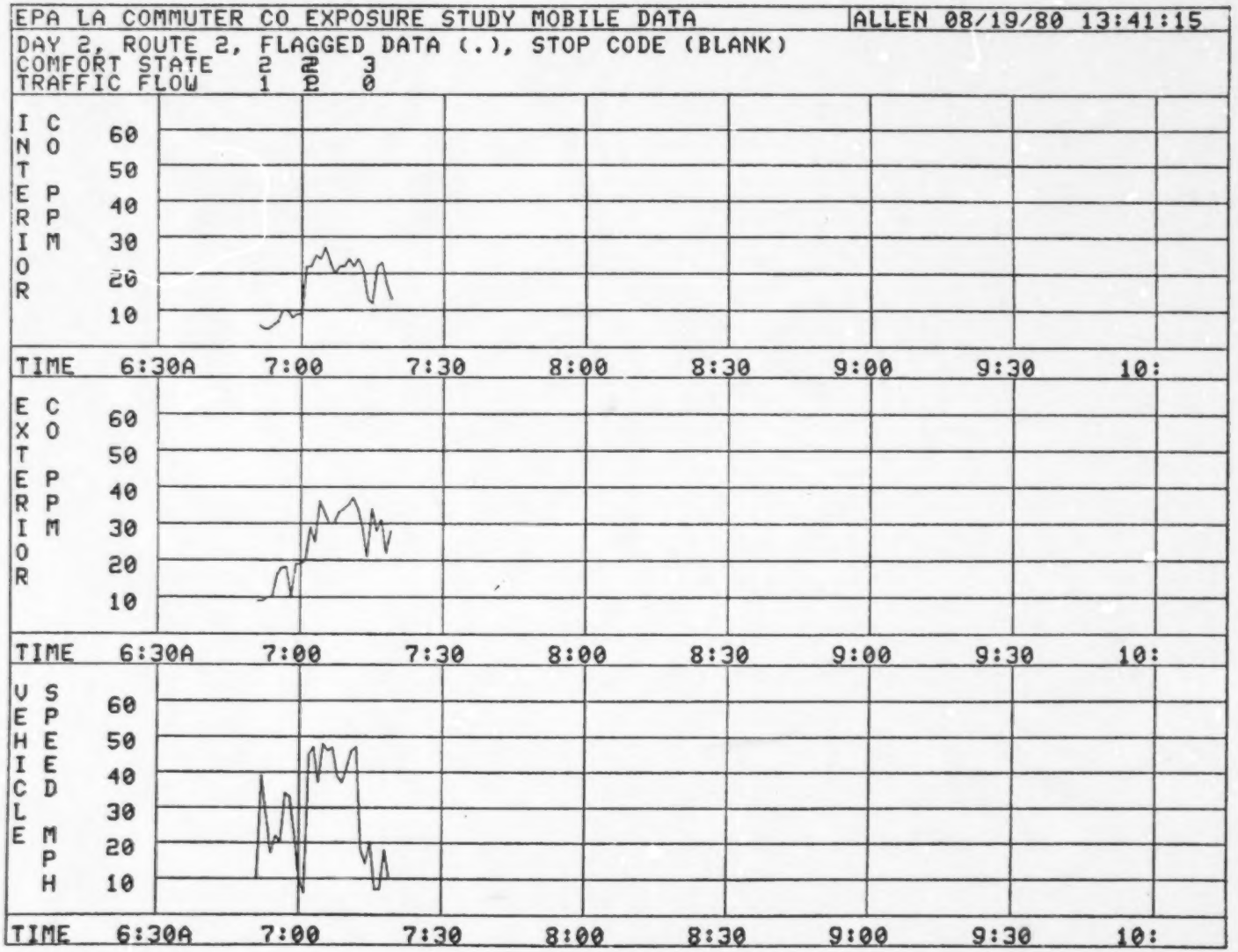
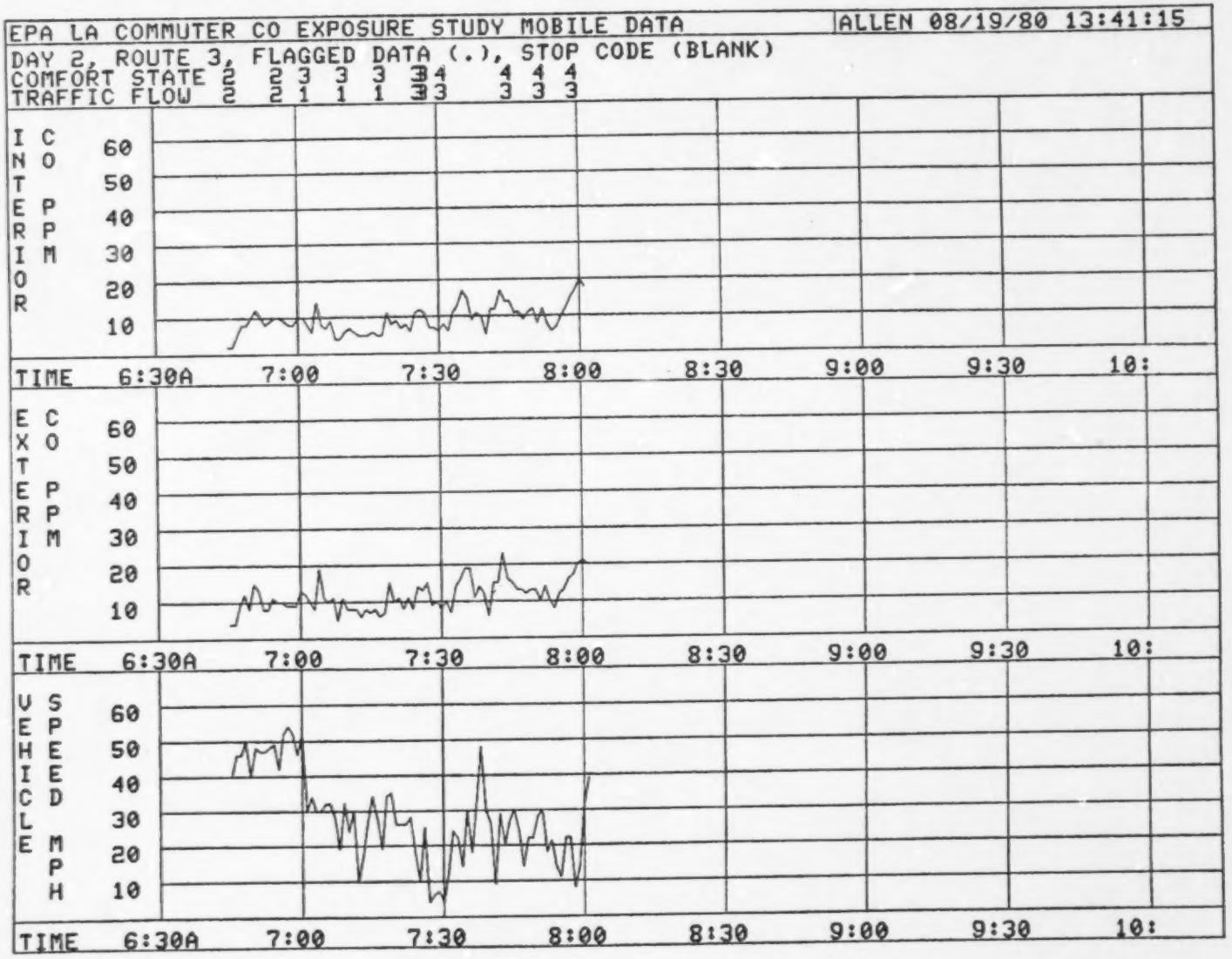
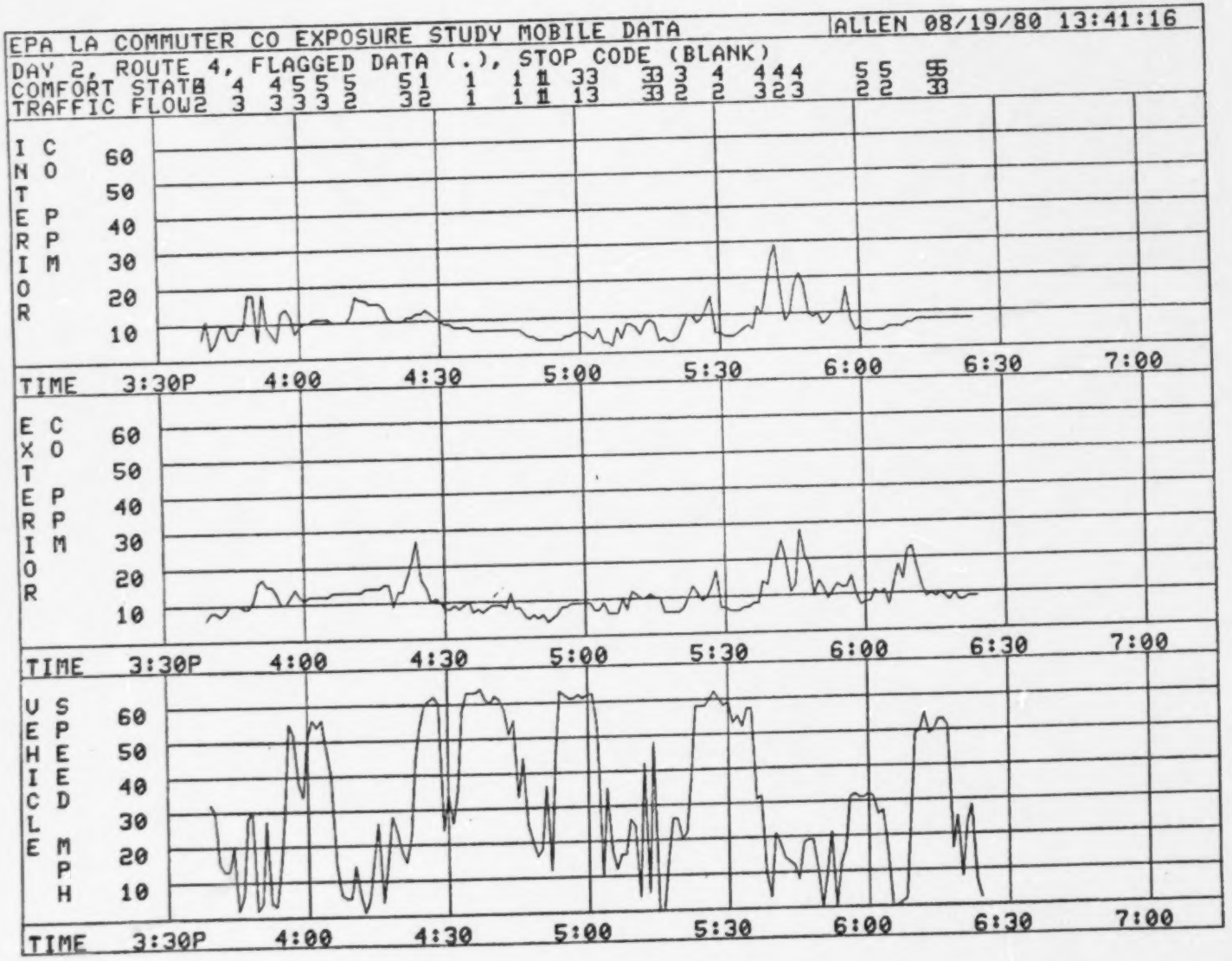
COMFORT STATE 2 2 3 3 3 4 4 4 4 4 5 5 5 5 5 1 1 1 2 2 2 2
TRAFFIC FLOW 2 2 2 2 1 2 1 1 1 3 3 3 2 1 3 2 3 2 2 2 2 2 2
INTERIOR CO PPM
EXTERIOR CO PPM
VEHICLE SPEED MPH
60
50
40
30
20
10
TIME 6:30A 7:00 7:30 8:00 8:30 9:00 9:30 10:


EPA LA COMMUTER CO EXPOSURE STUDY MOBILE DATA
ALLEN 08/19/80 13:41:15
DAY 2, ROUTE 2, FLAGGED DATA (.), STOP CODE (BLANK)
COMFORT STATE 2 2 3
TRAFFIC FLOW 1 1 0
INTERIOR CO PPM
EXTERIOR CO PPM
VEHICLE SPEED MPH
60
50
40
30
20
10
TIME 6:30A 7:00 7:30 8:00 8:30 9:00 9:30 10:


EPA LA COMMUTER CO EXPOSURE STUDY MOBILE DATA
ALLEN 08/19/80 13:41:15
DAY 2, ROUTE 3, FLAGGED DATA (.), STOP CODE (BLANK)
COMFORT STATE 2 2 3 3 3 3 4 4 4 4
TRAFFIC FLOW 2 2 1 1 1 3 3 3 3 3
INTERIOR CO PPM
EXTERIOR CO PPM
VEHICLE SPEED MPH
60
50
40
30
20
10
TIME 6:30A 7:00 7:30 8:00 8:30 9:00 9:30 10:


EPA LA COMMUTER CO EXPOSURE STUDY MOBILE DATA
ALLEN 08/19/80 13:41:16
DAY 2, ROUTE 4, FLAGGED DATA (.), STOP CODE (BLANK)
COMFORT STATB 4 4 5 5 5 5 1 1 1 11 33 33 3 4 4 4 4 5 5 55
TRAFFIC FLOW2 3 3 3 3 2 3 2 1 1 1 11 13 33 2 2 3 2 3 2 2 33
INTERIOR CO PPM
EXTERIOR CO PPM
VEHICLE SPEED MPH
60
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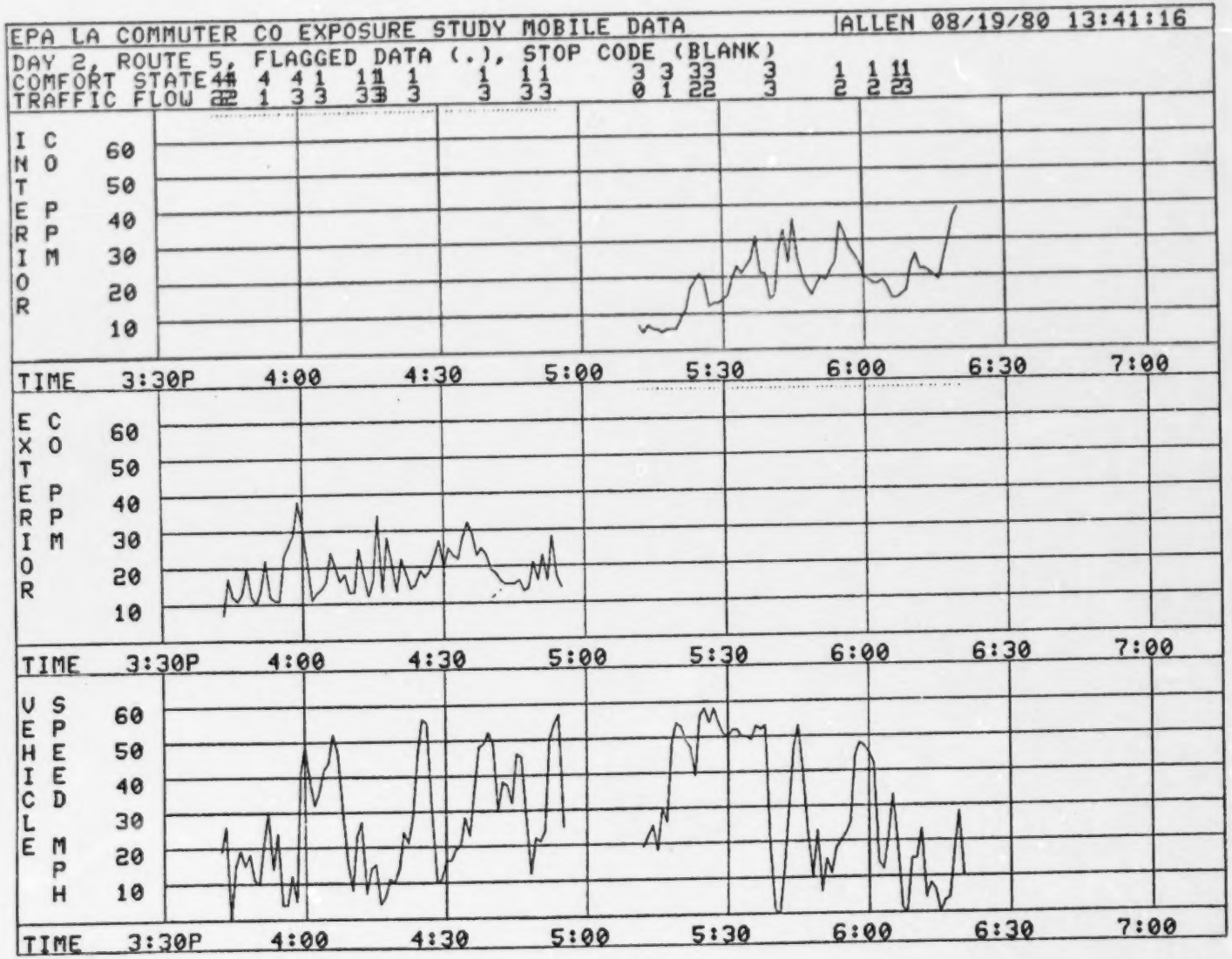
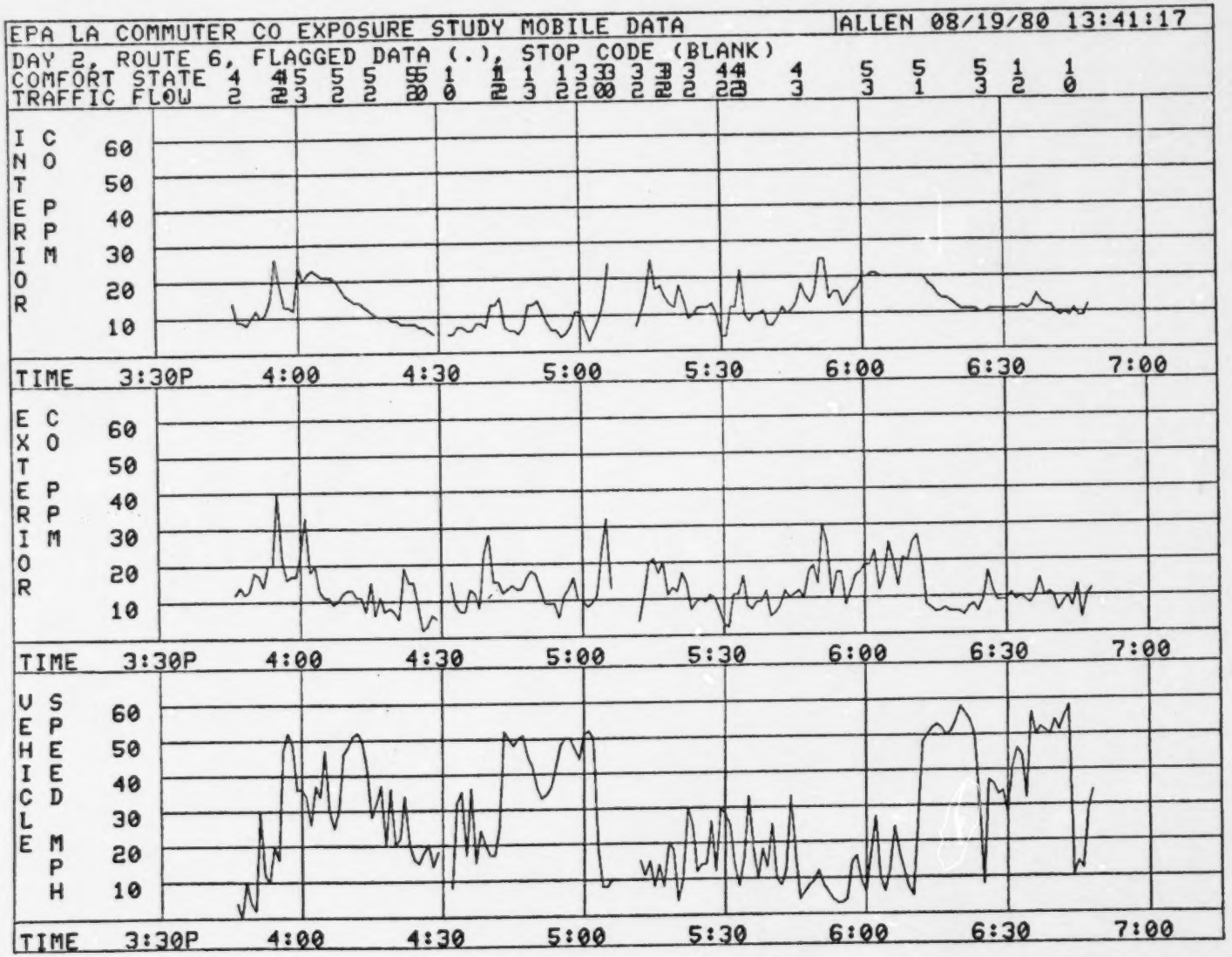
40
30
20
10
TIME 3:30P 4:00 4:30 5:00 5:30 6:00 6:30 7:00


EPA LA COMMUTER CO EXPOSURE STUDY MOBILE DATA
ALLEN 08/19/80 13:41:16
DAY 2, ROUTE 5, FLAGGED DATA (.), STOP CODE (BLANK)
COMFORT STATE
TRAFFIC FLOW
INTERIOR CO PPM
EXTERIOR CO PPM
VEHICLE SPEED MPH
TIME 3:30P 4:00 4:30 5:00 5:30 6:00 6:30 7:00
60
50
40
30
20
10


EPA LA COMMUTER CO EXPOSURE STUDY MOBILE DATA
ALLEN 08/19/80 13:41:17
DAY 2, ROUTE 6, FLAGGED DATA (.), STOP CODE (BLANK)
COMFORT STATE 4 4 5 5 5 5 1 1 1 1 3 3 3 3 3 4 4 4 5 5 5 1 1
TRAFFIC FLOW 2 2 3 2 2 2 0 2 3 2 2 0 0 2 2 2 2 3 3 3 1 3 2 0
INTERIOR CO PPM
60
50
40
30
20
10
TIME 3:30P 4:00 4:30 5:00 5:30 6:00 6:30 7:00
EXTERIOR CO PPM
60
50
40
30
20
10
TIME 3:30P 4:00 4:30 5:00 5:30 6:00 6:30 7:00
VEHICLE SPEED MPH
60
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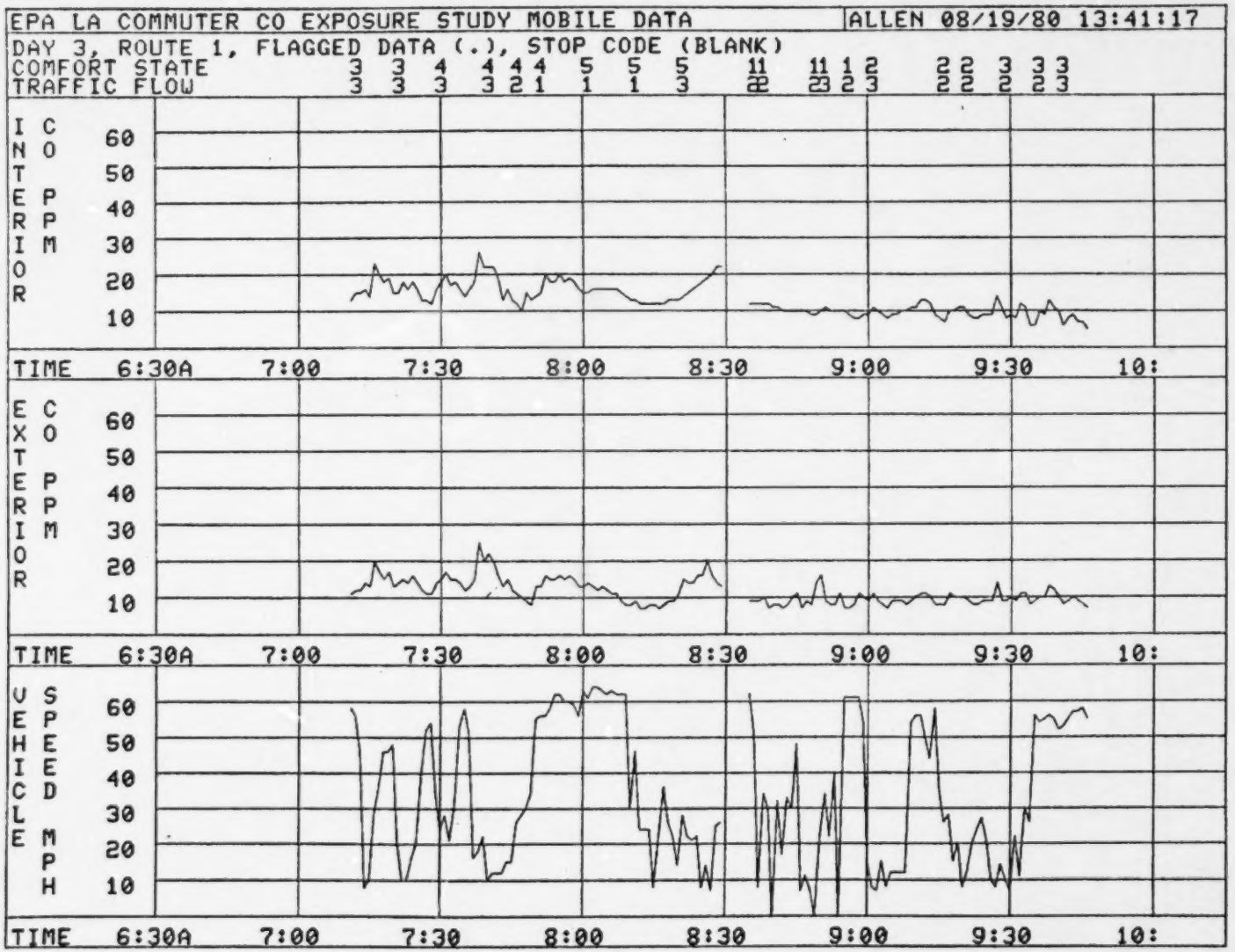
40
30
20
10
TIME 3:30P 4:00 4:30 5:00 5:30 6:00 6:30 7:00


EPA LA COMMUTER CO EXPOSURE STUDY MOBILE DATA
ALLEN 08/19/80 13:41:17
DAY 3, ROUTE 1, FLAGGED DATA (.), STOP CODE (BLANK)
COMFORT STATE 3 3 4 4 4 4 5 5 5 11 11 1 2 2 2 3 3 3
TRAFFIC FLOW 3 3 3 3 2 1 1 1 3 22 23 2 3 2 2 2 2 3
INTERIOR TEMP
EXTERIOR TEMP
VEHICLE SPEED MPH
60
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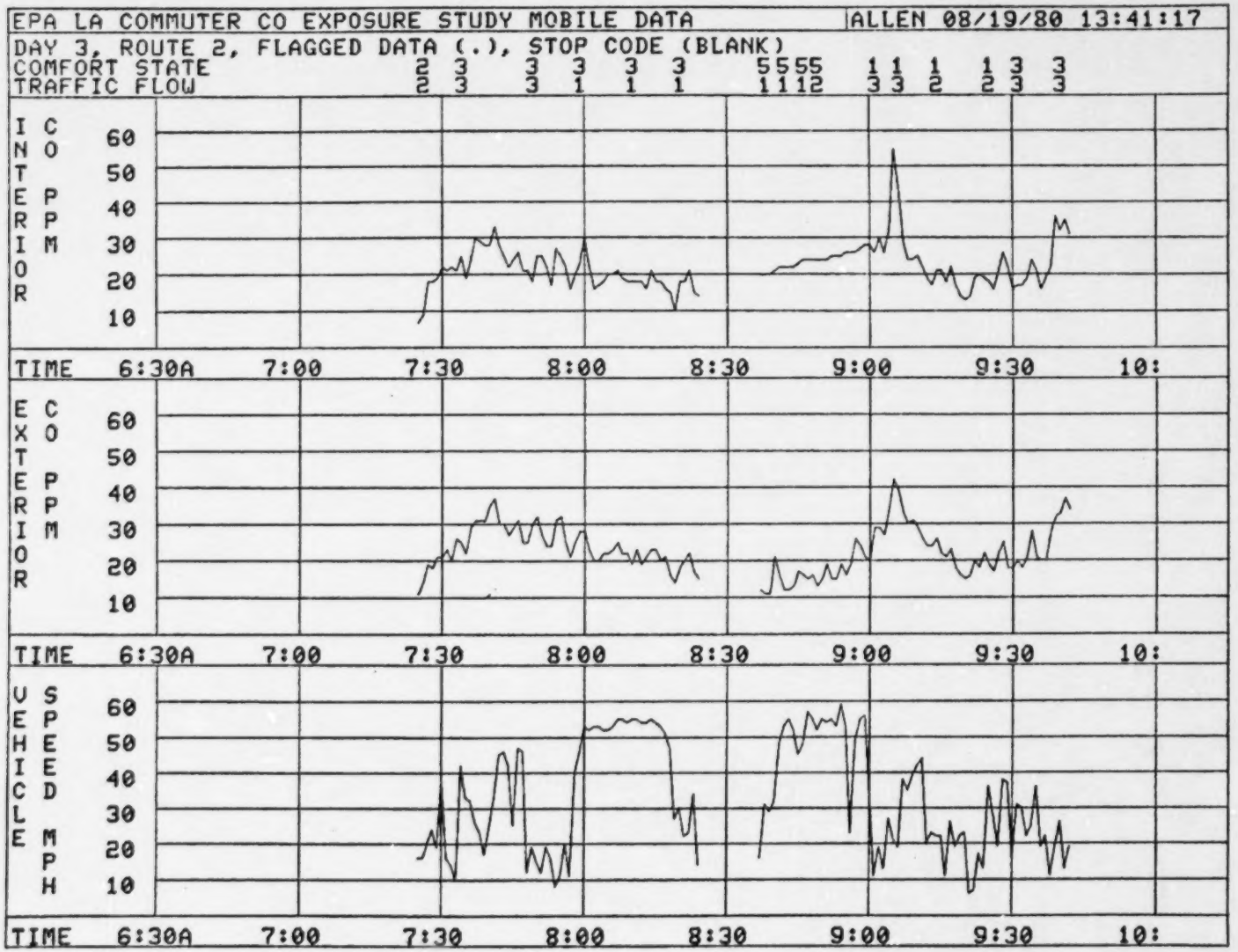
20
10
TIME 6:30A 7:00 7:30 8:00 8:30 9:00 9:30 10:


EPA LA COMMUTER CO EXPOSURE STUDY MOBILE DATA
ALLEN 08/19/80 13:41:17
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COMFORT STATE 2 3 3 3 3 3 5555 1 1 1 1 3 3
TRAFFIC FLOW 2 3 3 1 1 1 1112 3 3 2 2 3 3
INTERIOR CO PPM
EXTERIOR CO PPM
VEHICLE SPEED MPH
60
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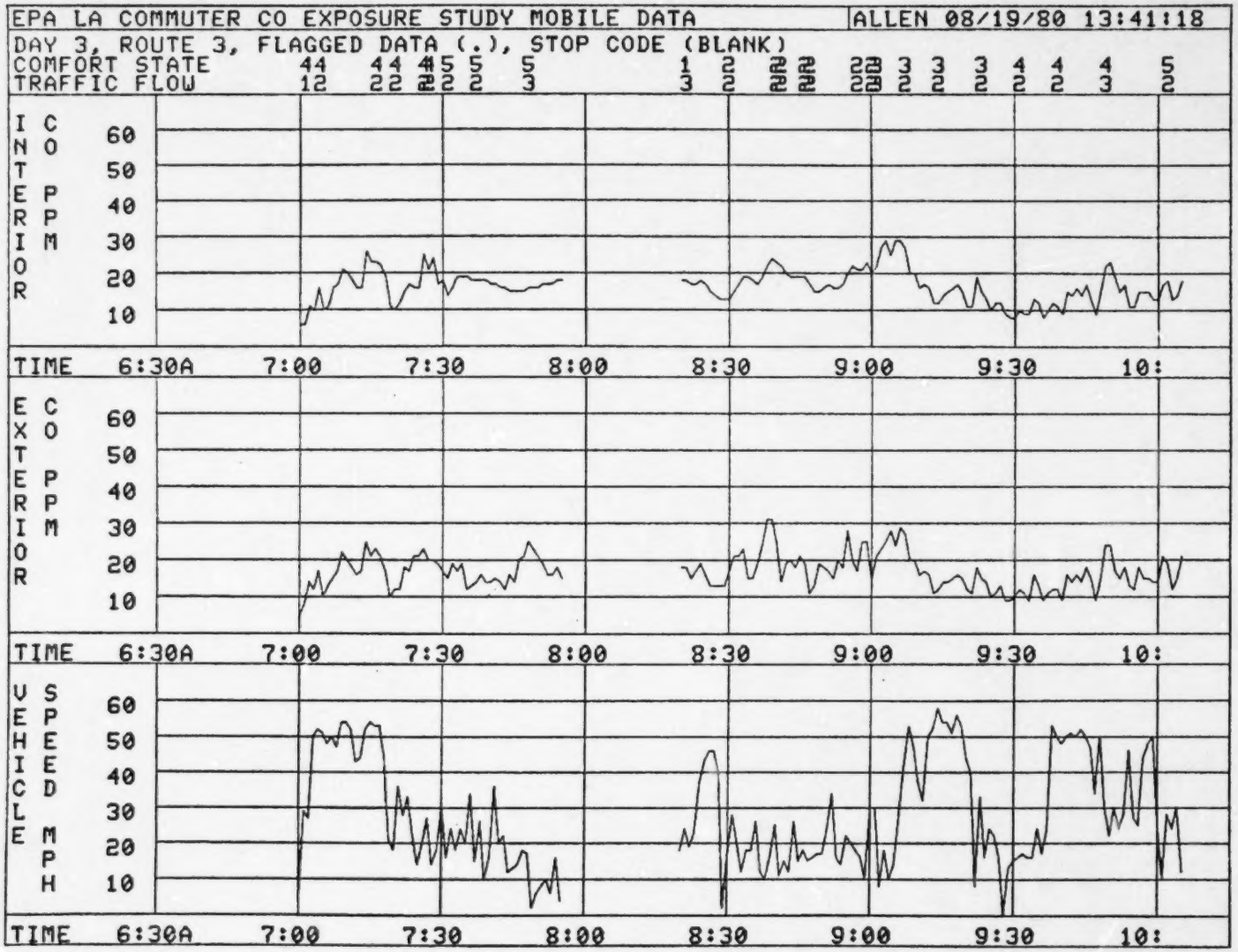
40
30
20
10
TIME 6:30A 7:00 7:30 8:00 8:30 9:00 9:30 10:


EPA LA COMMUTER CO EXPOSURE STUDY MOBILE DATA
ALLEN 08/19/80 13:41:18
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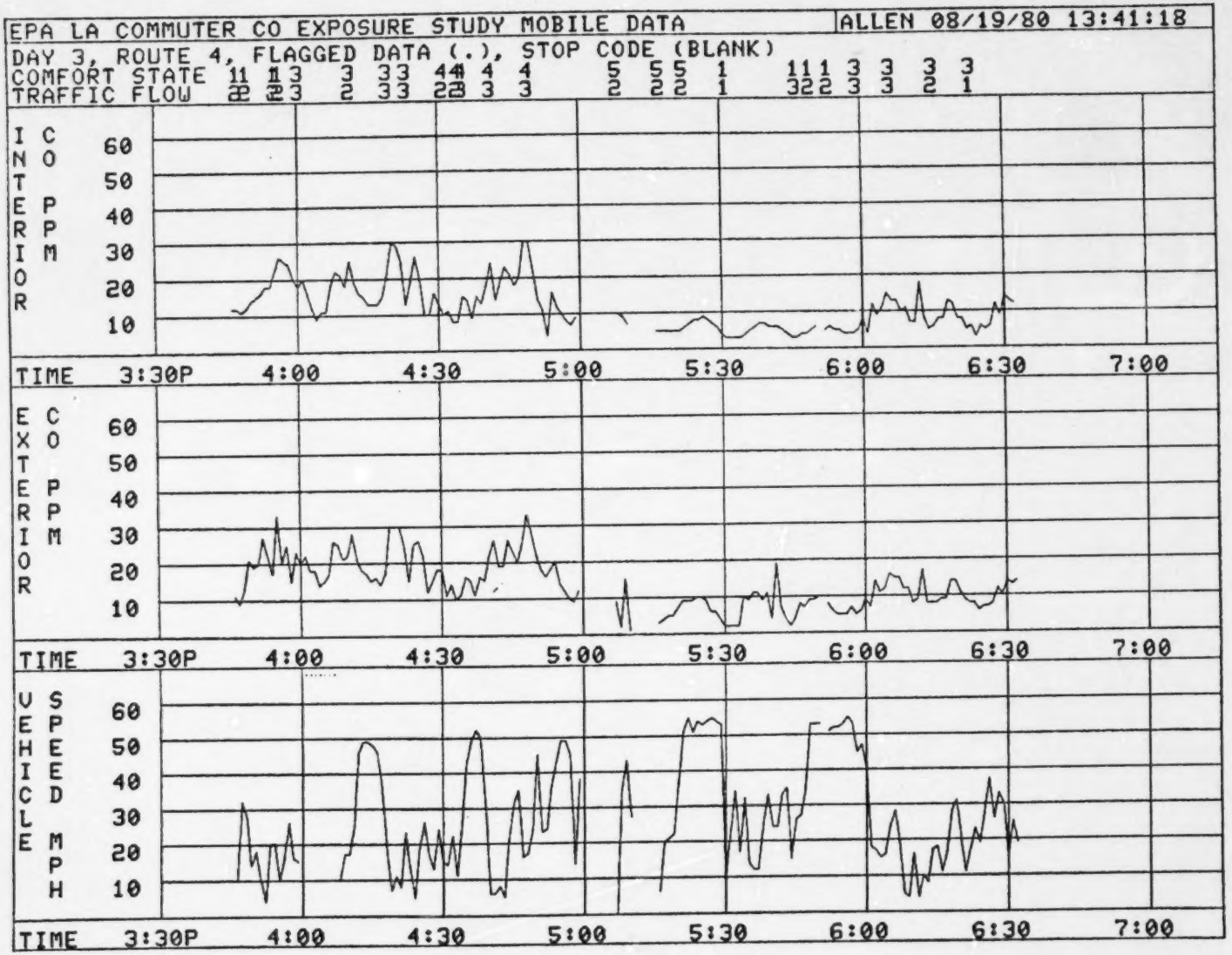
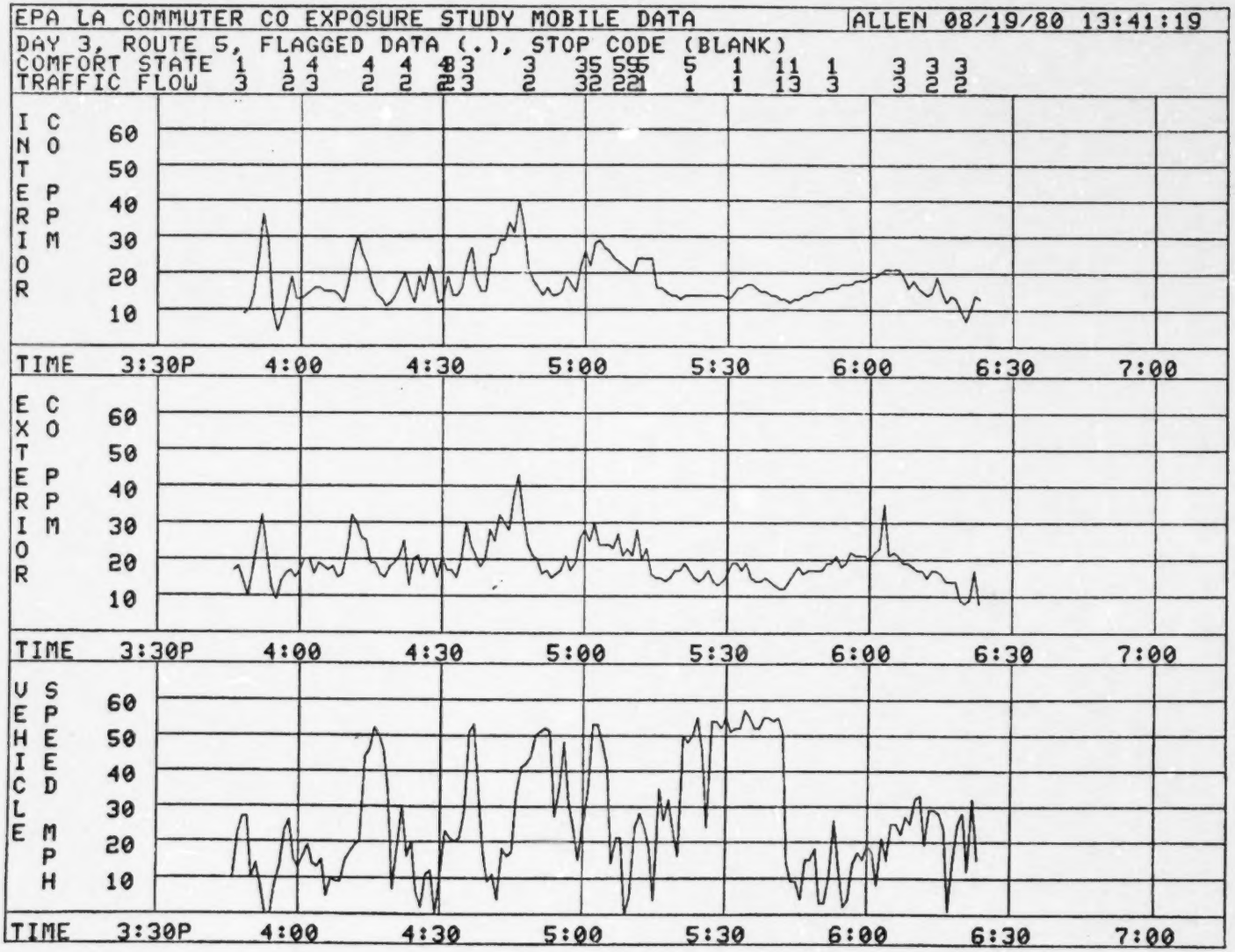
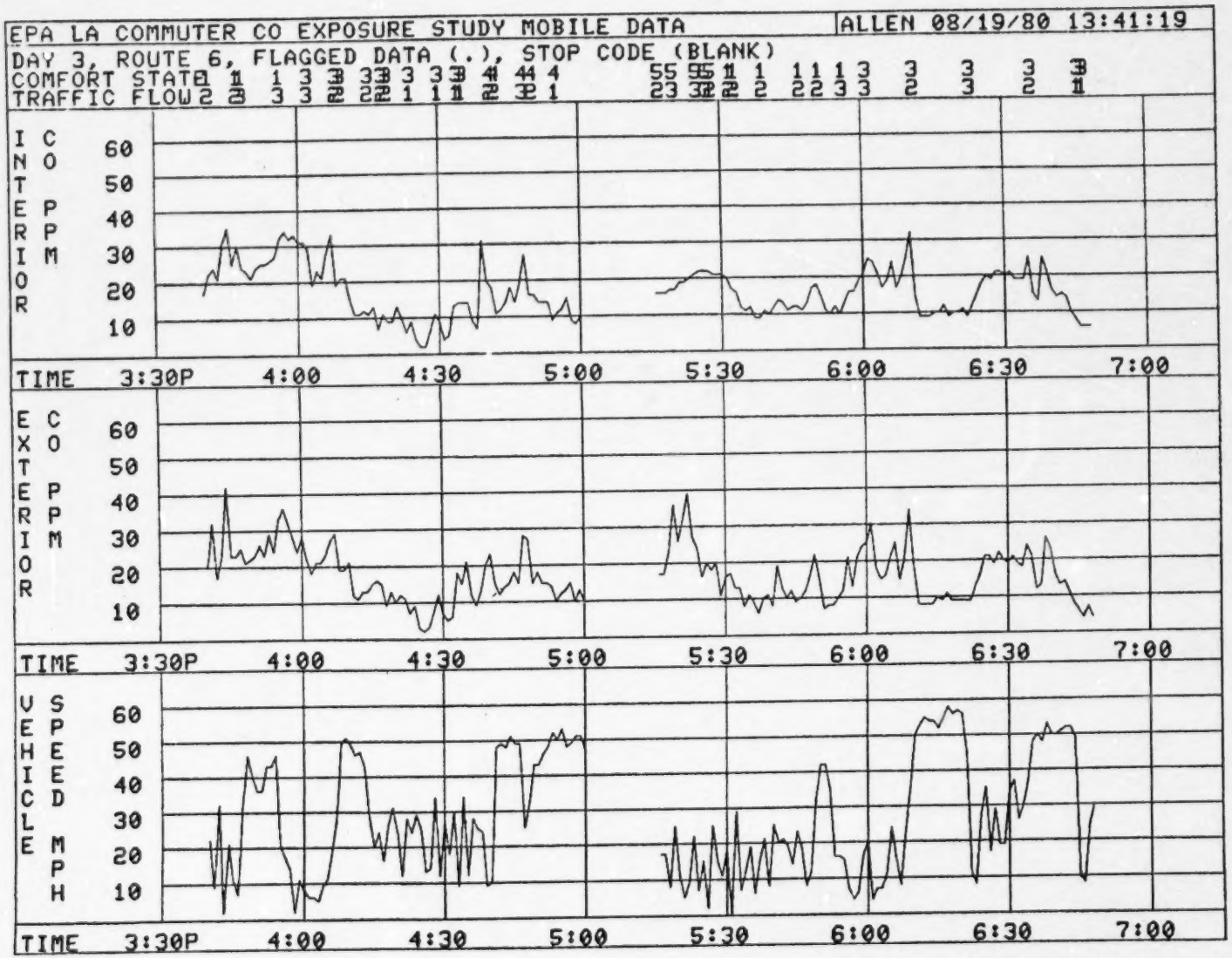
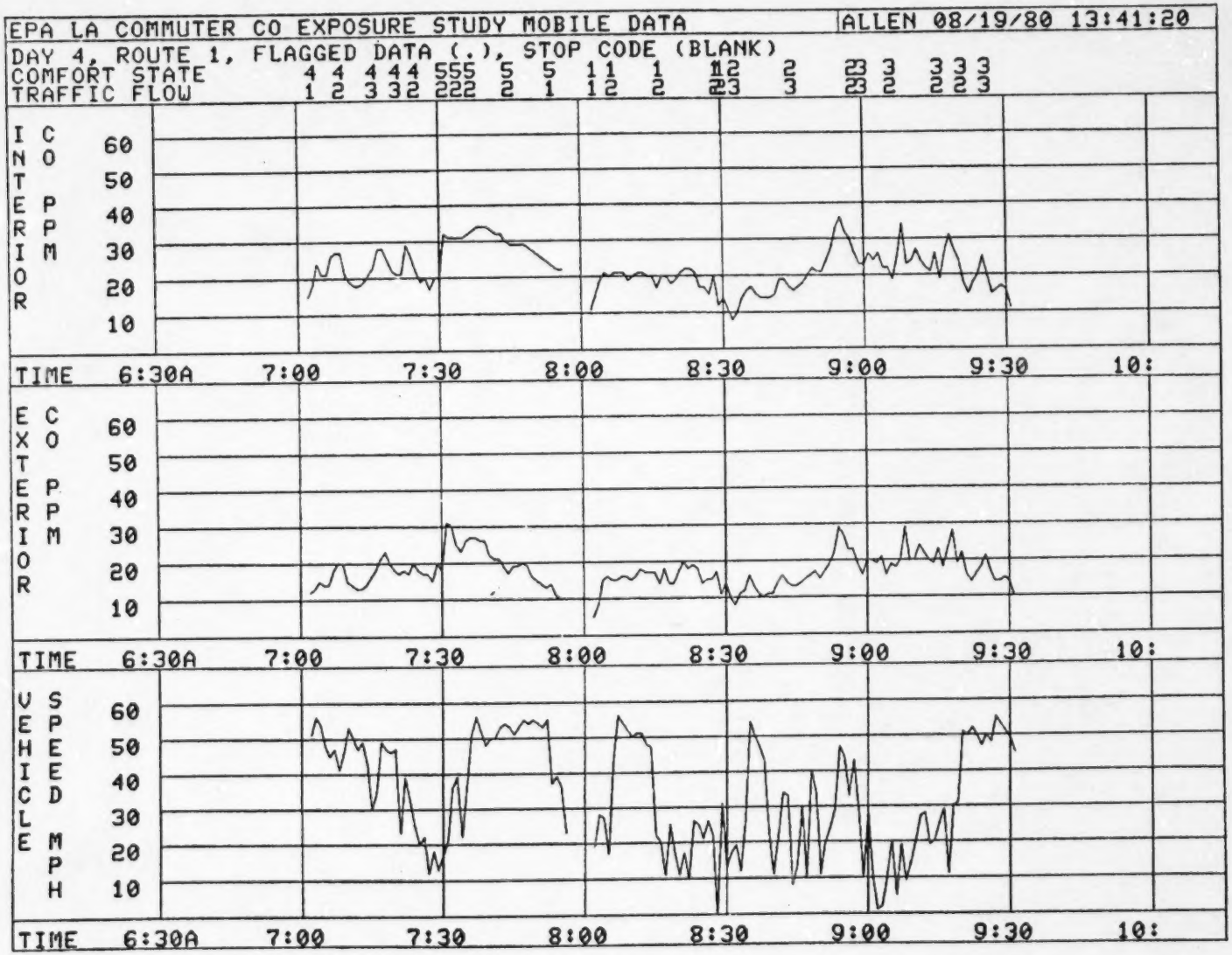
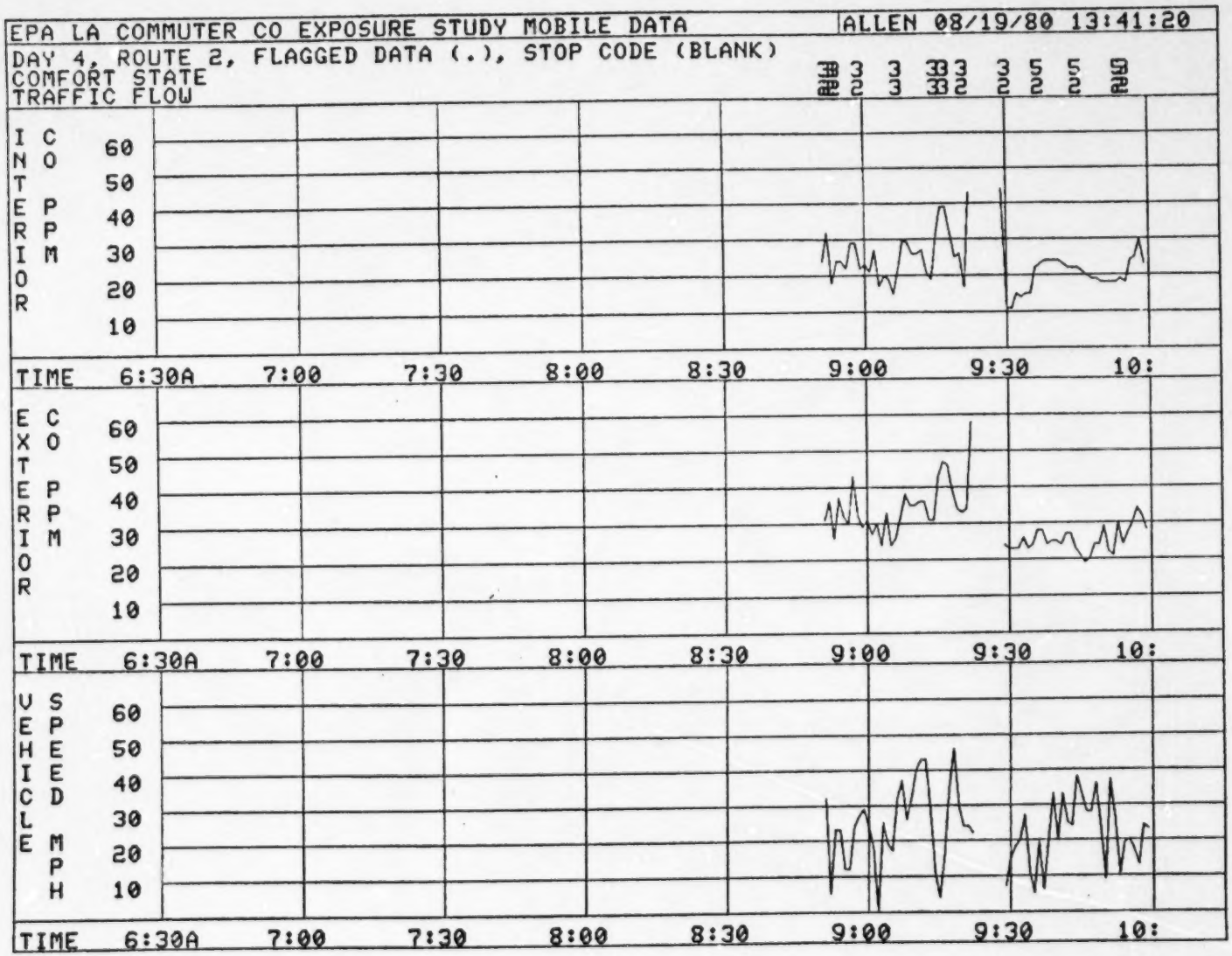
COMFORT STATE
TRAFFIC FLOW
INTERIOR CO PPM
EXTERIOR CO PPM
VEHICLE SPEED MPH
60
50
40
30
20
10
TIME 6:30A 7:00 7:30 8:00 8:30 9:00 9:30 10:

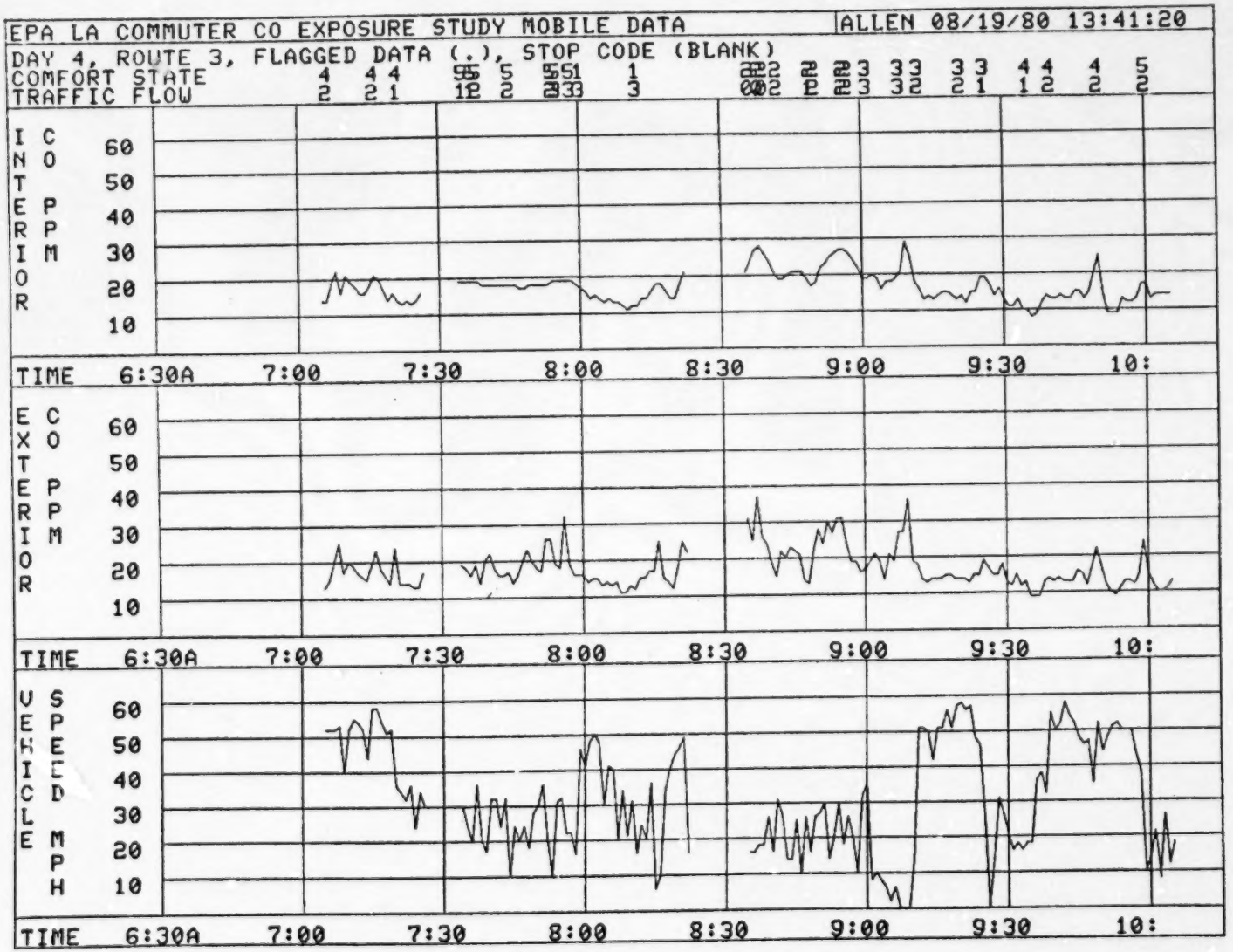

EPA LA COMMUTER CO EXPOSURE STUDY MOBILE DATA
ALLEN 08/19/80 13:41:18
DAY 3, ROUTE 4, FLAGGED DATA (.), STOP CODE (BLANK)
COMFORT STATE
TRAFFIC FLOW
INTERIOR CO PPM
EXTERIOR CO PPM
VEHICLE SPEED MPH
60
50
40
30
20
10
TIME 3:30P 4:00 4:30 5:00 5:30 6:00 6:30 7:00

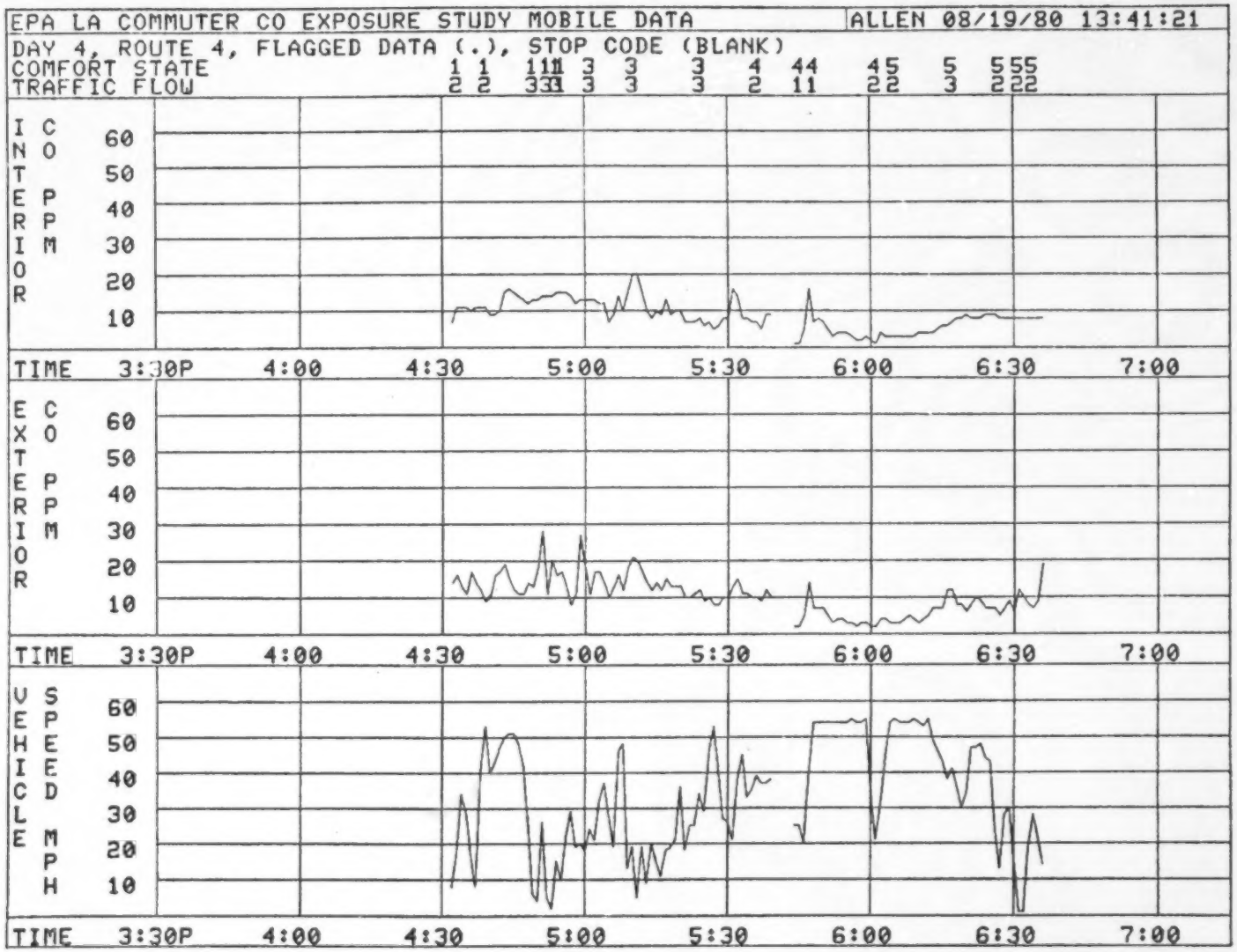

EPA LA COMMUTER CO EXPOSURE STUDY MOBILE DATA
ALLEN 08/19/80 13:41:19
DAY 3, ROUTE 5, FLAGGED DATA (.), STOP CODE (BLANK)
COMFORT STATE
TRAFFIC FLOW
INTERIOR CO PPM
EXTERIOR CO PPM
VEHICLE SPEED MPH
60
50
40
30
20
10
TIME 3:30P 4:00 4:30 5:00 5:30 6:00 6:30 7:00

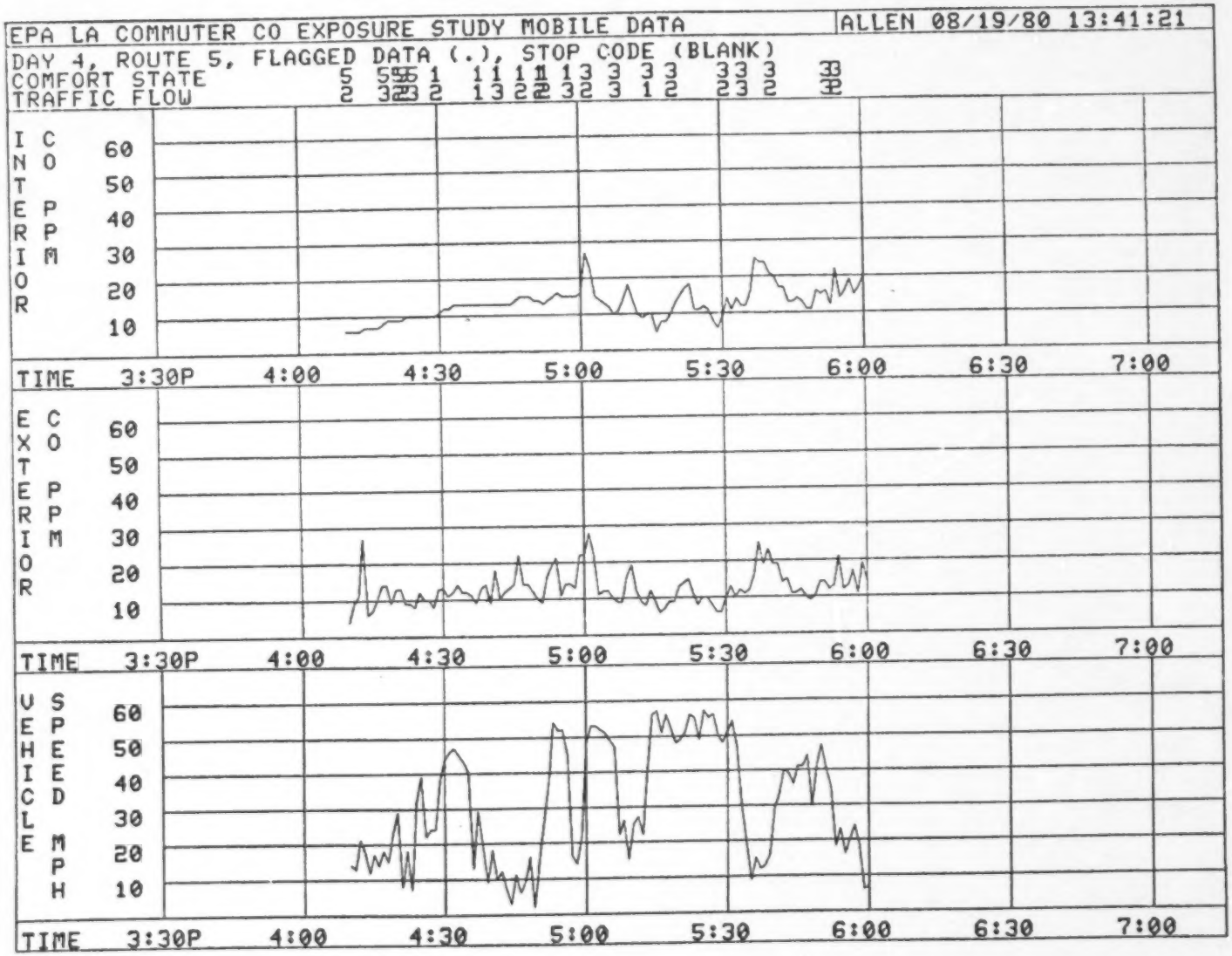

EPA LA COMMUTER CO EXPOSURE STUDY MOBILE DATA
ALLEN 08/19/80 13:41:19
DAY 3, ROUTE 6, FLAGGED DATA (.), STOP CODE (BLANK)
COMFORT STATE
TRAFFIC FLOW
INTERIOR CO PPM
EXTERIOR CO PPM
VEHICLE SPEED MPH
60
50
40
30
20
10
TIME 3:30P 4:00 4:30 5:00 5:30 6:00 6:30 7:00

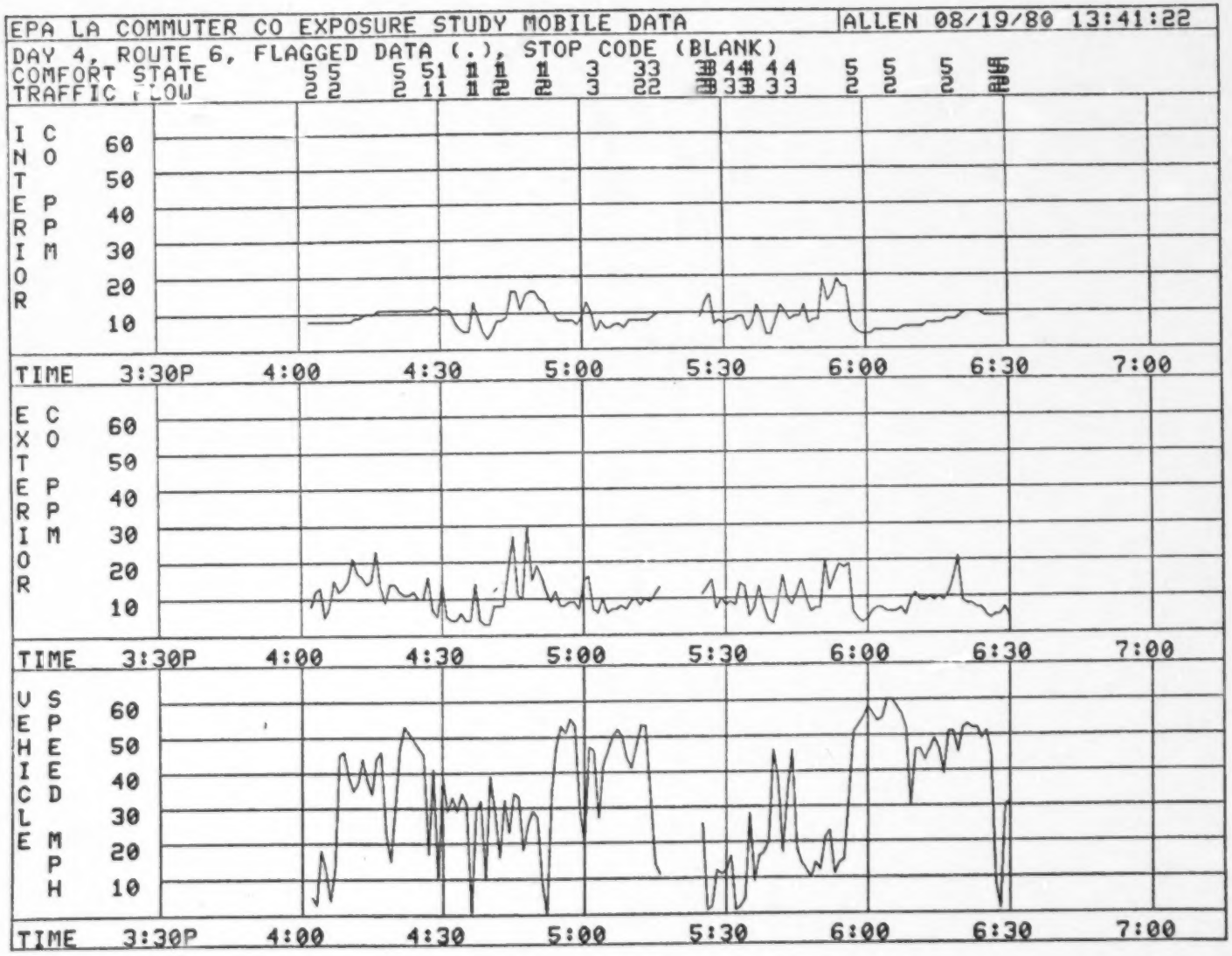

EPA LA COMMUTER CO EXPOSURE STUDY MOBILE DATA
ALLEN 08/19/80 13:41:20
DAY 4, ROUTE 1, FLAGGED DATA (.), STOP CODE (BLANK)
COMFORT STATE
TRAFFIC FLOW
INTERIOR CO PPM
EXTERIOR CO PPM
VEHICLE SPEED MPH
60
50
40
30
20
10
TIME 6:30A 7:00 7:30 8:00 8:30 9:00 9:30 10:

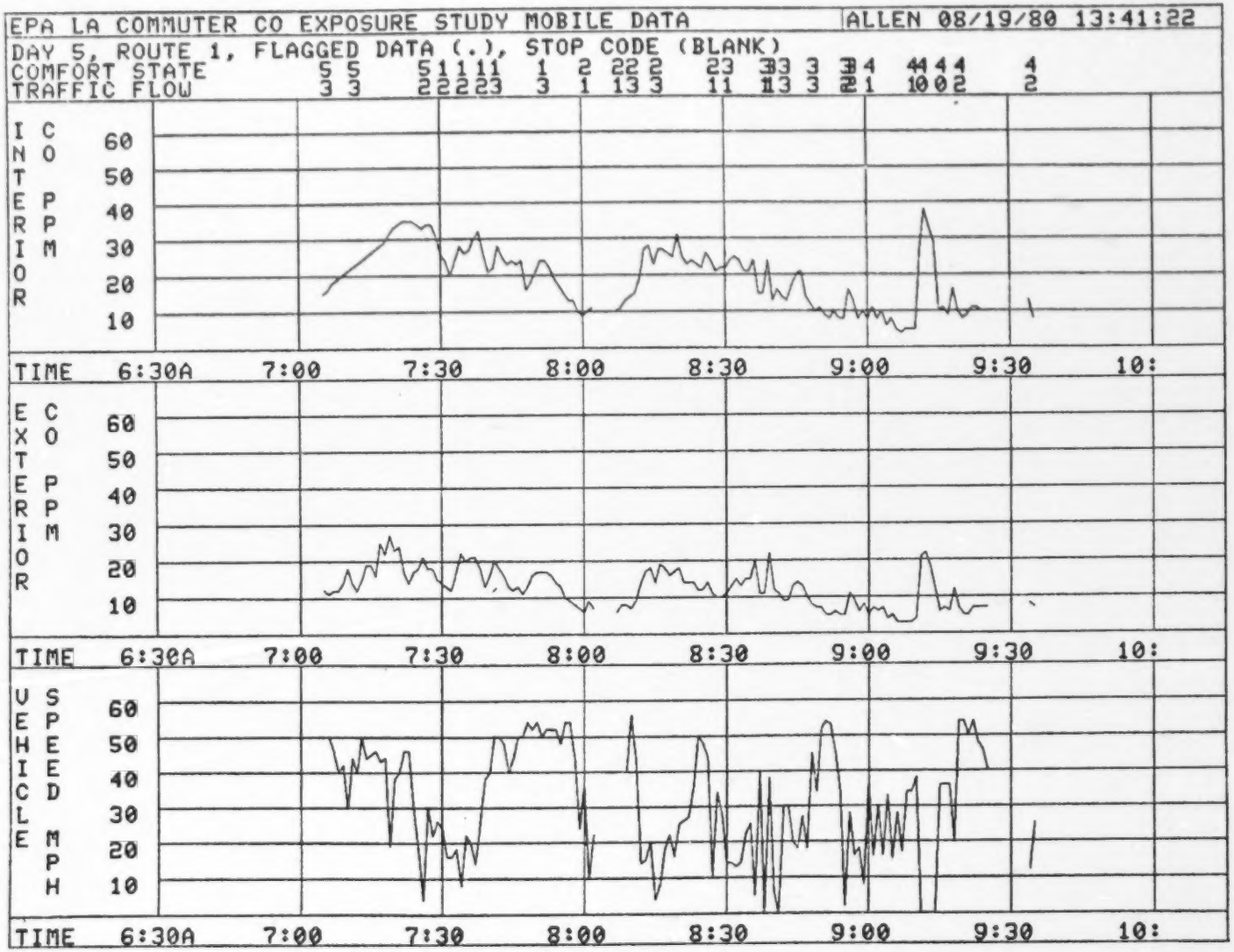

EPA LA COMMUTER CO EXPOSURE STUDY MOBILE DATA
ALLEN 08/19/80 13:41:20
DAY 4, ROUTE 2, FLAGGED DATA (.), STOP CODE (BLANK)
COMFORT STATE
TRAFFIC FLOW
INTERIOR CO PPM
EXTERIOR CO PPM
VEHICLE SPEED MPH
60
50
40
30
20
10
TIME 6:30A 7:00 7:30 8:00 8:30 9:00 9:30 10:

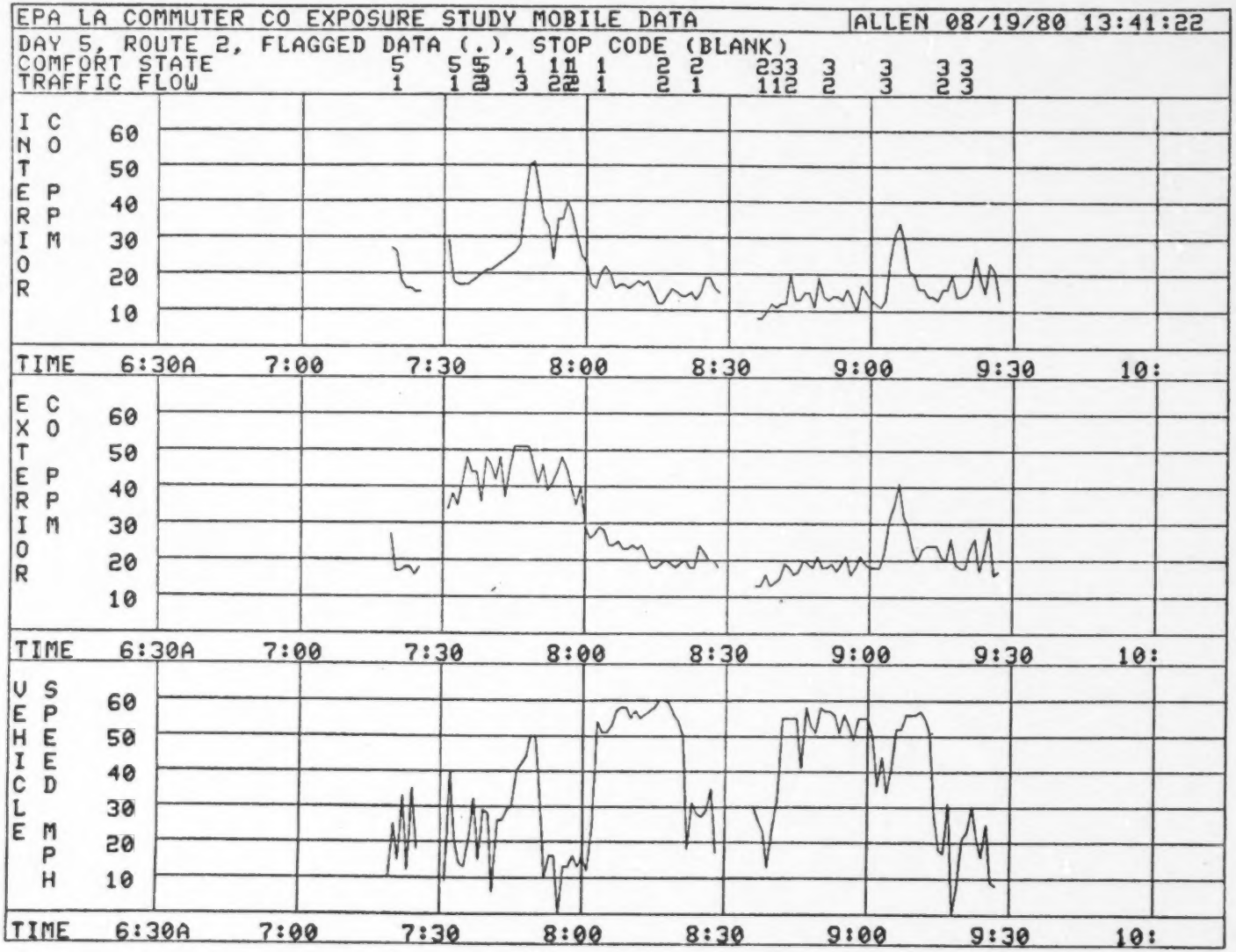

EPA LA COMMUTER CO EXPOSURE STUDY MOBILE DATA
ALLEN 08/19/80 13:41:20
DAY 4, ROUTE 3, FLAGGED DATA (.), STOP CODE (BLANK)
COMFORT STATE
TRAFFIC FLOW
INTERIOR CO PPM
EXTERIOR CO PPM
VEHICLE SPEED MPH
60
50
40
30
20
10
TIME 6:30A 7:00 7:30 8:00 8:30 9:00 9:30 10:

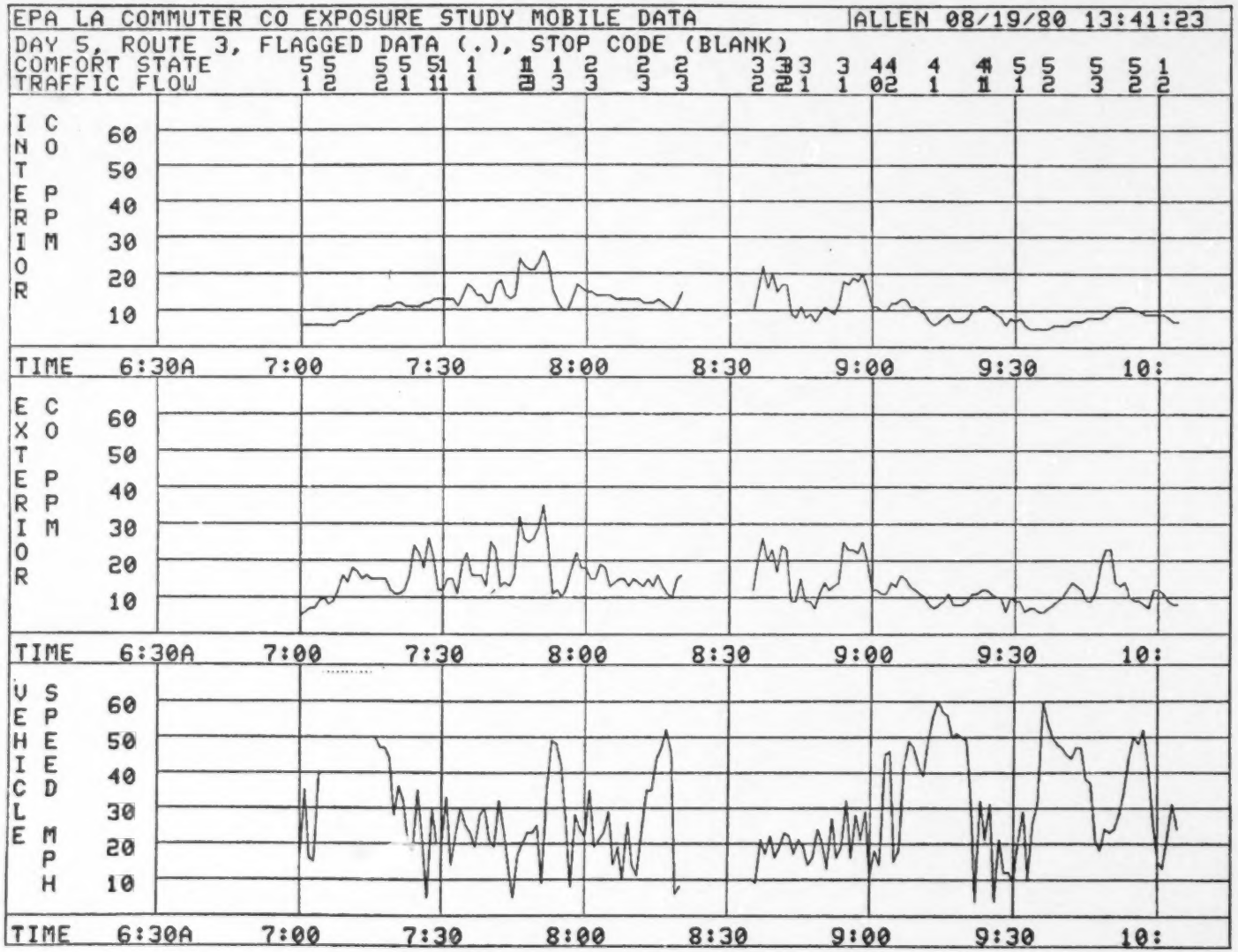

EPA LA COMMUTER CO EXPOSURE STUDY MOBILE DATA
ALLEN 08/19/80 13:41:21
DAY 4, ROUTE 4, FLAGGED DATA (.), STOP CODE (BLANK)
COMFORT STATE
TRAFFIC FLOW
INTERIOR CO PPM
EXTERIOR CO PPM
VEHICLE SPEED MPH
60
50
40
30
20
10
TIME 3:30P 4:00 4:30 5:00 5:30 6:00 6:30 7:00

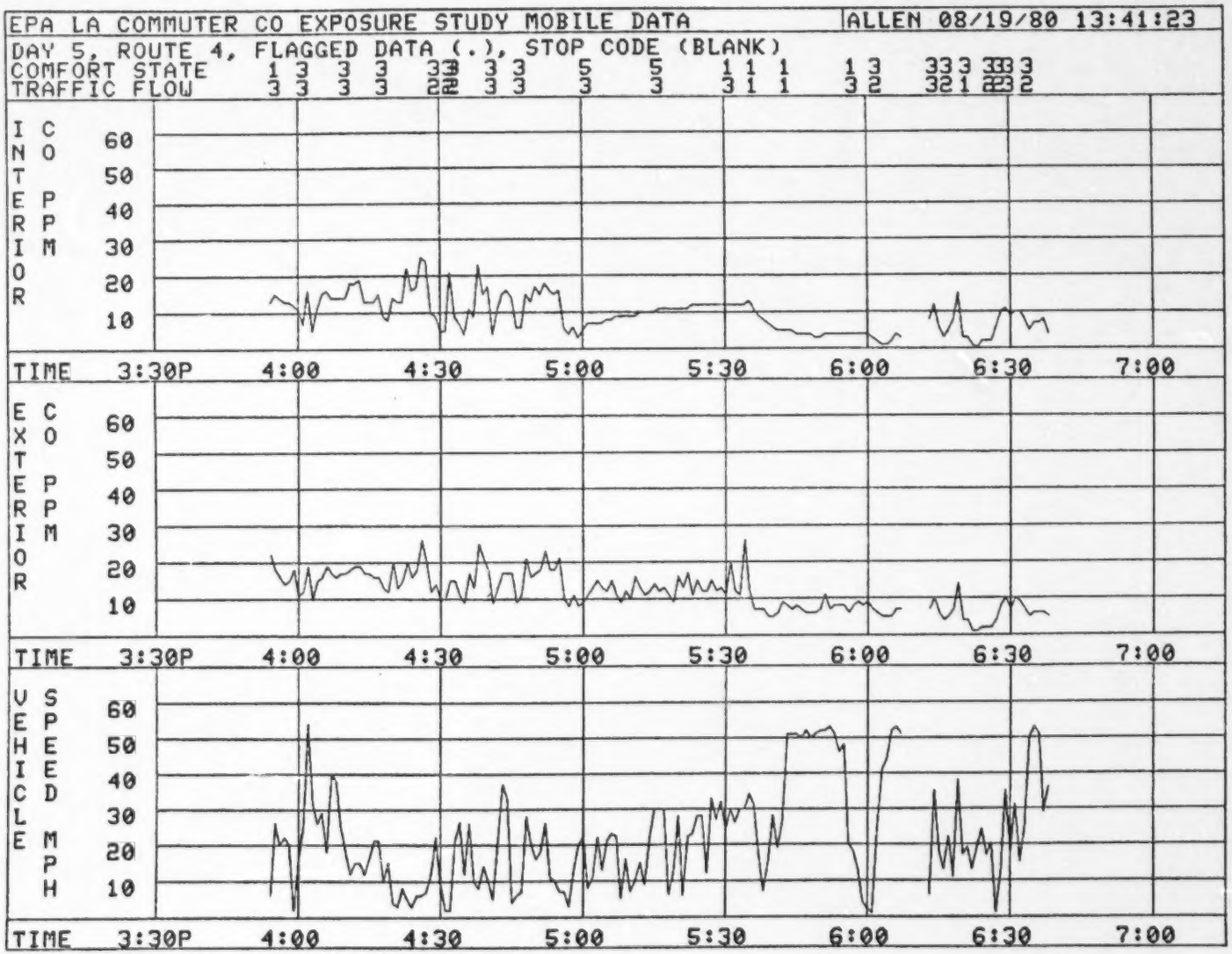

EPA LA COMMUTER CO EXPOSURE STUDY MOBILE DATA
ALLEN 08/19/80 13:41:21
DAY 4, ROUTE 5, FLAGGED DATA (.), STOP CODE (BLANK)
COMFORT STATE
TRAFFIC FLOW
INTERIOR CO PPM
EXTERIOR CO PPM
VEHICLE SPEED MPH
TIME 3:30P 4:00 4:30 5:00 5:30 6:00 6:30 7:00

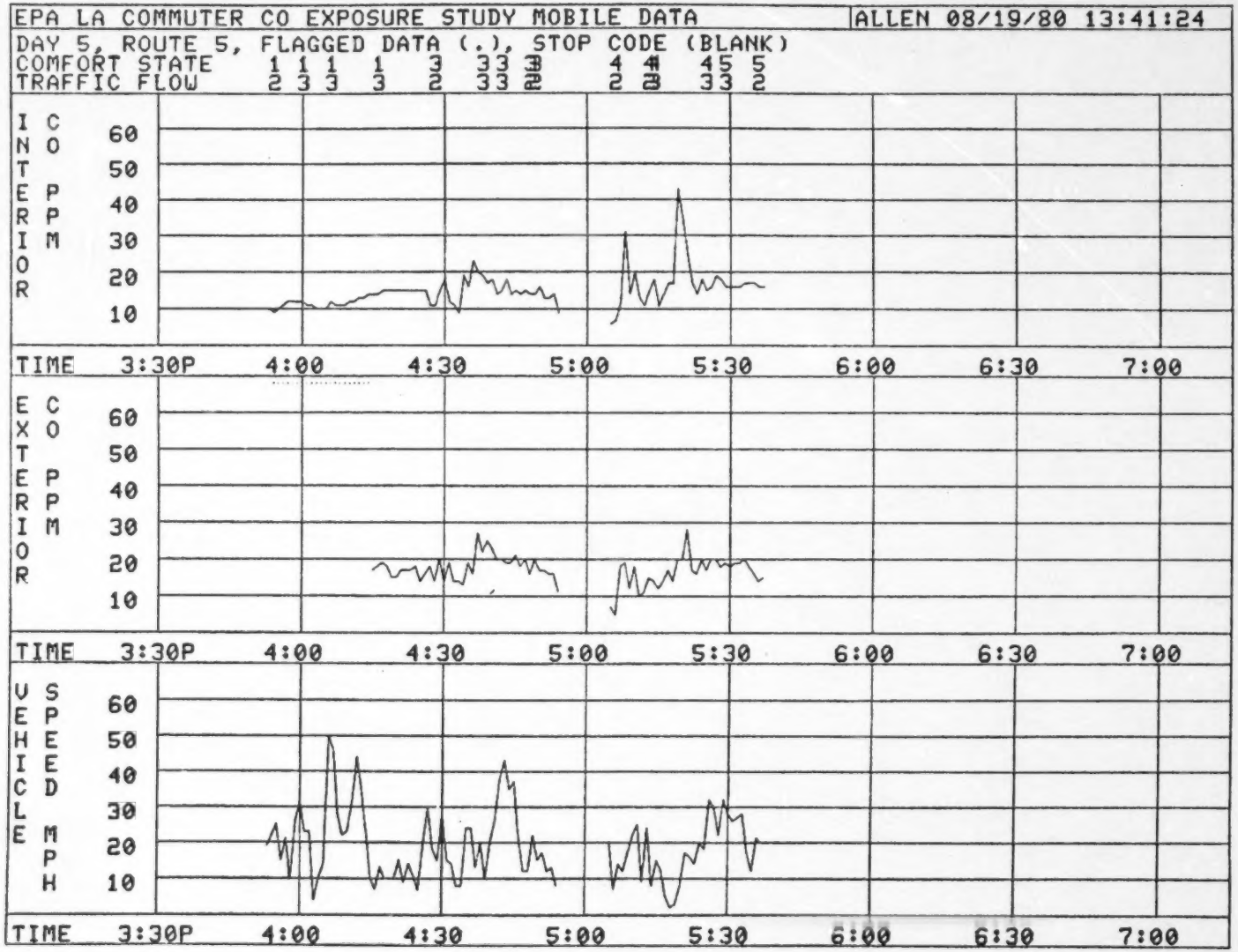

EPA LA COMMUTER CO EXPOSURE STUDY MOBILE DATA
ALLEN 08/19/80 13:41:22
DAY 4, ROUTE 6, FLAGGED DATA (.), STOP CODE (BLANK)
COMFORT STATE
TRAFFIC FLOW
INTERIOR CO PPM
EXTERIOR CO PPM
VEHICLE SPEED MPH
60
50
40
30
20
10
TIME 3:30P 4:00 4:30 5:00 5:30 6:00 6:30 7:00

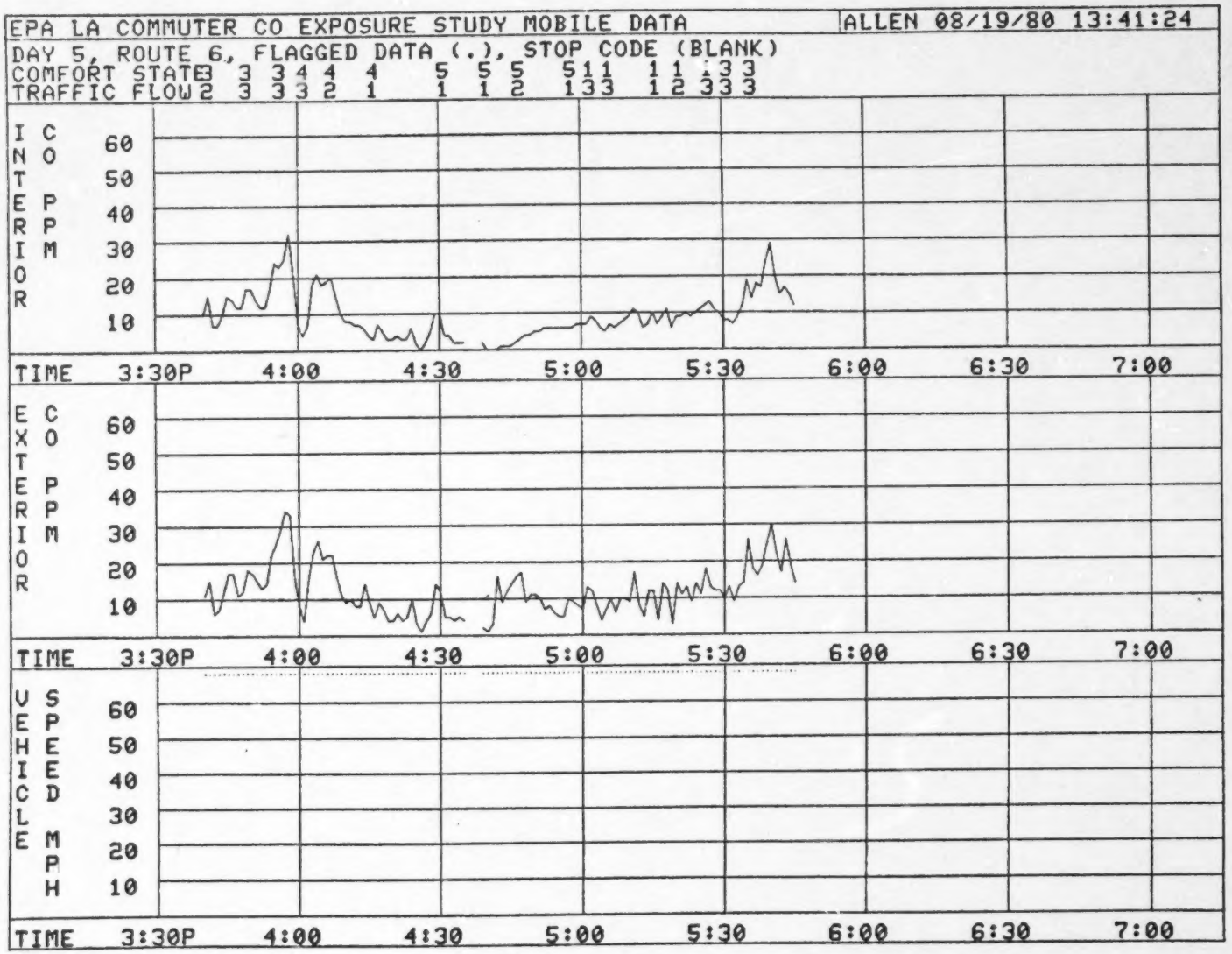

EPA LA COMMUTER CO EXPOSURE STUDY MOBILE DATA
ALLEN 08/19/80 13:41:22
DAY 5, ROUTE 1, FLAGGED DATA (.), STOP CODE (BLANK)
COMFORT STATE
TRAFFIC FLOW
INTERIOR CO PPM
EXTERIOR CO PPM
VEHICLE SPEED MPH
TIME 6:30A 7:00 7:30 8:00 8:30 9:00 9:30 10:


EPA LA COMMUTER CO EXPOSURE STUDY MOBILE DATA
ALLEN 08/19/80 13:41:22
DAY 5, ROUTE 2, FLAGGED DATA (.), STOP CODE (BLANK)
COMFORT STATE
TRAFFIC FLOW
INTERIOR CO PPM
EXTERIOR CO PPM
VEHICLE SPEED MPH
60
50
40
30
20
10
TIME 6:30A 7:00 7:30 8:00 8:30 9:00 9:30 10:


EPA LA COMMUTER CO EXPOSURE STUDY MOBILE DATA
ALLEN 08/19/80 13:41:23
DAY 5, ROUTE 3, FLAGGED DATA (.), STOP CODE (BLANK)
COMFORT STATE
TRAFFIC FLOW
INTERIOR CO PPM
EXTERIOR CO PPM
VEHICLE SPEED MPH
60
50
40
30
20
10
TIME 6:30A 7:00 7:30 8:00 8:30 9:00 9:30 10:


EPA LA COMMUTER CO EXPOSURE STUDY MOBILE DATA
ALLEN 08/19/80 13:41:23
DAY 5, ROUTE 4, FLAGGED DATA (.), STOP CODE (BLANK)
COMFORT STATE
TRAFFIC FLOW
INTERIOR CO PPM
EXTERIOR CO PPM
VEHICLE SPEED MPH
60
50
40
30
20
10
TIME 3:30P 4:00 4:30 5:00 5:30 6:00 6:30 7:00


EPA LA COMMUTER CO EXPOSURE STUDY MOBILE DATA
ALLEN 08/19/80 13:41:24
DAY 5, ROUTE 5, FLAGGED DATA (.), STOP CODE (BLANK)
COMFORT STATE 1 1 1 1 3 33 3 4 4 45 5
TRAFFIC FLOW 2 3 3 3 2 33 2 2 2 33 2
INTERIOR CO PPM
EXTERIOR CO PPM
VEHICLE SPEED MPH
60
50
40
30
20
10
TIME 3:30P 4:00 4:30 5:00 5:30 6:00 6:30 7:00


EPA LA COMMUTER CO EXPOSURE STUDY MOBILE DATA
ALLEN 08/19/80 13:41:24
DAY 5, ROUTE 6, FLAGGED DATA (.), STOP CODE (BLANK)
COMFORT STATE 3 3 4 4 4 5 5 5 5 1 1 1 1 . 3 3
TRAFFIC FLOW 2 3 3 3 2 1 1 1 2 1 3 3 1 2 3 3 3
INTERIOR CO PPM
EXTERIOR CO PPM
VEHICLE SPEED MPH
60
50
40
30
20
10
TIME 3:30P 4:00 4:30 5:00 5:30 6:00 6:30 7:00